THE
WORKS
OF
M. DE VOLTAIRE.

TRANSLATED FROM THE FRENCH.

WITH

NOTES, HISTORICAL AND CRITICAL.

BY T. SMOLLETT, M.D.
T. FRANCKLIN, M.A. AND OTHERS.

IN TWENTY-FOUR VOLUMES.

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AUG 17 1912
CAMBRIDGE

VOLUME XVI.

THE FOURTH EDITION.

DUBLIN:
PRINTED BY R. MARCHBANK,
FOR R. MONCRIEFFE IN CAPEL-STREET.
M,DCC,LXXII.

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SIXTEENTH VOLUME.

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PHILOSOPHICAL

MISCELLANIES.

Miſcellaneous Pieces.

REMARKS

ON

MR. PASCAL'S THOUGHTS.

YOU have here the remarks which I made ſome time ſince on Mr. Paſcal's thoughts. Let me deſire you however not to compare me on this occaſion to Hezekiah, who was for having all the works of Soloman burnt. I have a profound reſpect for Mr. Paſcal's genius and eloquence, but this reſpect ſerves to convince me that he himſelf would have corrected many of thoſe thoughts, which he occaſionally committed to paper, with an intention of examining them afterwards, and at the ſame time that I combat his opinions, I admire his genius.

It appears to me that Mr. Paſcal's deſign in general was to exhibit mankind in an odious light. He exacts the uttermoſt efforts of his pen, to make us all appear a wicked and wretched ſet of beings. He writes againſt the human ſpecies, in much the ſame ſtrain as he wrote againſt the Jeſuits. He aſcribes to the eſſence of our nature things that are peculiar to ſome men only, and with all imaginable eloquence abuſes the whole race of mankind. I ſhall be ſo bold to defend my fellow creatures againſt the invectives of this ſublime Miſanthropiſt. I will venture to affirm,

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that we are neither ſo wretched nor ſo wicked as he declares us to be. I am likewiſe fully perſuaded, that had he, in the book he propoſed to write, carried into execution the plan laid down by him in his thoughts, it would have been a work full of eloquent falſe reaſonings and untruths, reduced in a wonderful manner. I even think that the great number of books, which have been written of late years to prove the truth of the Chriſtian religion, ſo far from edifying the reader, will be found ſo many ſtumbling blocks. Do theſe authors pretend to know more of this matter than Chriſt and his apoſtles? This is like proping up an oak with reeds to prevent it from falling, tho' the latter may very ſafely be rooted up without prejudicing the oak in any manner.

I have ſelected ſome of Paſcal's thoughts, at diſcretion, and annexed my remarks or anſwers to each of them.

And here it cannot be too often repeated, that it is the height of abſurdity and malice, to make a party affair of this examination. I acknowledge no party but that of truth: I am of opinion that it is an undoubted truth, that it is not the buſineſs of Metaphyſics to prove the truth of the Chriſtian religion, and that reaſon is as much inferior to faith, as the finite is to the infinite. Here we are to conſult only reaſon, and that is a thing of ſo little conſequence, that it is not worth the trouble of contending about.

I. THOUGHT.

" The greatneſs and miſery of man are ſo viſible
" that true religion muſt neceſſarily have taught us,
" that theſe are inherently in him, ſo mighty a prin-
" ciple of greatneſs, and at the ſame time ſome mighty
" principle of miſery, for true religion cannot but be
" perfectly acquainted with our nature, by which I
" mean, that it muſt know the utmoſt extent of its
" greatneſs and miſery, and the reaſon of both: from
" true religion likewiſe we muſt learn the reaſon of

" thoſe aſtoniſhing contrarieties which are found on " that occaſion."

1. This way of reaſoning ſeems falſe and dangerous, for the fable of Prometheus and Pandora, the Androgyni of Plato, and the tenets of the antient Egyptians, and of Zoroaſter, would account as well for thoſe apparent contrarieties: the Chriſtian religion would remain true, even tho' no perſon ſhould draw thoſe ingenious concluſions from it, which can ſerve only to ſhew the brilliant imagination of thoſe who favour them: to eſtabliſh the truth of a religion, it is neceſſary it ſhould be revealed, without explaining to us the reaſon of theſe ſuppoſed contrarieties, and we are no more to expect Metaphyſical lights from it than Aſtronomical ones.

II.

" Let us examine on this head, all the known re-" ligions in the world, and then we ſhall ſee if there " is any other ſince that of Chriſtianity capable of " ſatisfying us herein. Will it be taught by the philo-" ſophers, who propoſe to us, as the only good, the " good inherent in ourſelves? But is this true good? " Will this be found a remedy to our evils?"

2. The philoſophers never taught a religion, and their philoſophy was not the ſubject to be combated. No philoſopher ever pretended to be inſpired by the Almighty, for had he done this he would no longer have acted in the character of a philoſopher, but that of a prophet. The queſtion is not to inquire, whether Jeſus Chriſt ought to be preferred to Ariſtotle, but to prove that the religion of the former is the true one, and that thoſe of Mahomet, Zoroaſter, Confucius, Hermes, and every other are falſe. It is not true that the philoſophers have propoſed to us, as the only good, the good inherent within us. Read Plato, Marcus Aurelius, and Epictetus, you will find they endeavour to inſpire us with a deſire of meriting a reunion with the divine Eſſence, from whence we originally ſprung.

III.

" And yet without this myſtery, which is of all " others the moſt incomprehenſible, we are incom" prehenſible to ourſelves. The knot of our condi" tion has all its turns, and plies in the abyſs of " original ſins; inſomuch that man is more incompre" henſible without this myſtery, than this myſtery is " incomprehenſible to man."

3. What an unaccountable way of reaſoning is this! man is incomprehenſible without this incomprehenſible myſtery? Certainly it is enough to be wholly ignorant of our origin, without going about to explain it by a thing we know nothing of: we are wholly in the dark, as to the manner in which man comes into the world, how he grows, how he performs the various functions of life, and how his members are made to act ſubſervient to his will. How ſhould I be looked upon if I went about to explain theſe obſcurities by an unintelligible ſyſtem? Would it not be better to confeſs I know nothing of the matter? A myſtery never was the explanation of any thing, it is ſomething divine and wholly inexplicable in itſelf.

What anſwer would Mr. Paſcal have made to any who ſhould have ſpoke to him in this manner? I know that the myſtery of original ſin is the object of faith not of reaſon. I very well conceive without a myſtery what man is; I perceive that he comes into the world like other animals; that women of the moſt delicate conſtitutions have the hardeſt labours; that women and the females among brutes ſometimes loſe their lives in bringing forth; that ſometimes the organs of young children are ſo unhappily form'd, that they remain deprived of one or more of their ſenſes, void of the enjoyment of the rational faculties; that thoſe whoſe paſſions are moſt lively are found to have the leaſt conſtructed organs; that the principle of ſelf love is equally predominant in all men, and that they ſtand in no leſs need of them than of the free ſenſes; that God inſpired us with this principle of ſelf love for the preſervation of our being, and gave his religion to govern this ſelf love; that our ideas are juſt and inconſiſtent, clear or dark, according to the ſtrength or weakneſs of our organs, or in proportion to our prejudices; that we depend entirely on the air that ſurrounds us and the food we eat; and that there is nothing inconſiſtent nor contradictory in all this.

Man is not ſuch a riddle as you may figure him to yourſelf to be, merely to have the pleaſure of ſolving it. Man appears to hold his due place in the ſcale of beings, ſuperior to brutes, whom he reſembles with regard to the organs, but inferior to other beings, to whom he very poſſibly may bear a reſemblance with reſpect to thought. Man is like every thing elſe we ſee round us, a compoſition in which good and evil, pleaſures and pains, are found. He has paſſions to excite him to action, and reaſon to direct thoſe actions. If man was perfect he would be God; and thoſe contrarieties which you call contradictions are ſo many neceſſary ingredients to the compoſition of man, who is like every thing elſe in nature, juſt what he ought to be. Thus might reaſon argue, it is therefore not reaſon that teaches man the face of human nature, and it is to faith only we ought to have recourſe.

IV.

" Let us follow our own impulſes, turn our eyes
" inward, and ſee whether we do not therein find the
" living characteriſtics of thoſe two natures.

" It is impoſſible for ſo great a number of contra-
" dictions to be found united in one and the ſame
" ſubject.

" The duplicity in man is ſo evident, that ſome
" have thence been reduced to think that we are in-
" formed with two ſouls, imagining it impoſſible for
" one ſingle ſubject to exhibit ſuch ſtrange and ſud-
" den varieties, and to change in an inſtant from the

" higheſt degree of preſumption to the moſt abject " ſtate of dependency."

4. This thought, as well as ſome others, is taken entirely from Montague, and is to be found in the chapter of the inconſtancy of human actions. But the wiſe Montague argues like a man who has ſome doubt. This diverſity in our wills is not ſo many contradictions in nature, and man is not a ſingle ſubject. He conſiſts of an innumerable multitude of organs. If only one of theſe be ever ſo little out of order, it muſt neceſſarily change all the impreſſions made on the brain, and the animal muſt be informed with new thoughts, and a new will. 'Tis very certain that we are ſometimes dejected with ſorrow, and at others elated with pride, and this muſt neceſſarily be the caſe when we are in oppoſite ſituations. An animal who is fed and fondled by his maſter, and another who is put to a lingering death, for anatomical purpoſes, feel very different ſenſations. 'Tis the ſame with regard to us, and that difference which is found in man is ſo far from being contradictory, that it would be contradictory were it not to be found. Thoſe madmen, who aſſerted we had two ſouls, might with equal reaſon have given us thirty or forty; for that man, whoſe ſpirits are ſtrongly agitated, has ſometimes thirty or forty ideas of the ſame thing, and muſt neceſſarily have ſuch ideas according to the different faces under which hat object appears to him. This pretended duplicity in man is an idea equally abſurd and metaphyſical. And it might with as much juſtice be aſſerted, that the dog who fawns and bites is double; that the mirrour which repreſents different objects is double; and that the tree which at one time is tufted with leaves, and at another preſents only naked branches to the view, is alſo double. I own indeed that man is incomprehenſible, but the whole of nature is ſo likewiſe; and we do not find a greater number of contradictions in man, than in the reſt of the creation.

V. " The

V.

" The not laying a wager that God exiſts, is laying
" that he does not exiſt: which ſide will you take?
" Let us weigh the loſs and gain, in believing that
" God exiſts. If you win you win all; if you loſe
" you loſe nothing: lay therefore without the leaſt
" heſitation that he exiſts. Yes, I muſt lay; but I
" poſſibly hazard too great a ſtake. Let us ſee ſince
" there is an equal chance whether you win or loſe
" if you were to ſtake one life againſt two, you ſure-
" ly might venture the wager.

5. It is a very falſe aſſertion, that the not laying a wager that God exiſts, is laying that he does not exiſt: for certainly that man, whoſe mind is in a ſtate of doubt, and is deſirous of being informed, aſſuredly does not lay on either ſide; moreover this article is really indecent and childiſh: the idea of gaming, of loſing and winning, is quite unſuitable to the dignity of the ſubject: farther, the intereſt I have to believe a thing is no proof that ſuch a thing exiſts. If you ſhould promiſe me the empire of the world, provided I would believe you were in the right, I ſhould undoubtedly, upon that offer being made, very readily agree that you might be in the right, but I cannot believe this till you have proved it to me. The firſt ſtep you ſhould take (might one ſay to Mr. Paſcal) would be to convince my reaſon; 'tis doubtleſs my intereſt to believe that there is a God, but if, according to the ſyſtem, God came but for ſo very few, if the number of the elect is ſo *alarmingly* ſmall; and if I am unable, from my own impulſe, to do any thing, be ſo good as to tell me what intereſt I can have in believing you? Is it not viſibly my intereſt to believe the direct contrary? With what face can you talk to me of infinite bliſs, to which ſcarce one man among a million has the leaſt claim? Would you really convince me you muſt take a different courſe, and not at one time talk to me of gaming, ſtaking heads or tails; and at another terrify me by ſcattering thorns up and

down the path which I ought and am determined to walk in; your reaſoning ſerves only to make men atheiſts, did not all nature proclaim the exiſtence of a God in a manner as forcible as thoſe ſubtilties are weak.

VI.

“ When I reflect on the blindneſs and miſery of “ man, and the aſtoniſhing contrarieties which diſcover “ themſelves in his nature; and when I behold the “ whole univerſe dumb, and man left to himſelf deſti- “ tute of lights, and wandering as it were in the work “ of the univerſe, without knowing who placed him “ there, what he is ſent to do, or what will become “ of him after death, I ſtart with horror, like a man, “ who, having been carried in his ſleep into a frightful “ deſert iſland, awakes and knows not where he is, “ nor how he can get out of this ſtrange place, to “ which he has been tranſported: on conſidering all “ this, I wonder that mankind are not ſeiz’d with “ deſpair every time they reflect on the wretchedneſs “ of their condition.”

6. Whilſt I was peruſing this reflection I read a letter from a friend, who lives in a far diſtant country, who writes me thus: *

“ I am at this time exactly the ſame as when you left me, neither gayer or more dejected; neither richer nor poorer; I enjoy a perfect ſtate of health, and am bleſt with every thing that can make life agreeable; undiſturbed by love, by avarice, by ambition, or envy; and I think, ſo long as theſe things laſt, I may continue to pronounce myſelf a very happy man.”

Many men are as happy as the writer of this letter. ’Tis with man as with the brute creature. One dog ſhall eat and lie with his miſtreſs, another ſhall be deſtin’d to turn the ſpit and is equally happy, a third runs mad

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* He has ſince been ambaſſador, and is now raiſed to a very high rank in life. I have his original letter, which was written in 1728, ſtill by me.

mad and is knock'd on the head. For my part when I take a view of London or Paris, I ſee no cauſe for the violent deſpair mentioned by Mr. Paſcal. I ſee a city which bears not the leaſt reſemblance to a deſert iſland, but on the contrary a populous, rich and well governed place, where mankind are as happy as it is conſiſtent with their nature to be. What man in his ſenſes would ſink in deſpair becauſe he does not know the nature of his own thoughts, that he is acquainted with only a few of the qualities of matter, or becauſe that God has not revealed to him all his ſecrets? He might as juſtly deſpond becauſe he has not four feet and a pair of wings: why ſhould any one go about to make us reflect on our being with horror? Our exiſtence is not ſo wretched as ſome perſons would make us believe it to be. To conſider the univerſe as a dreary dungeon, and all mankind as ſo many condemn'd wretches carrying to execution, is the idea of a mad enthuſiaſt: to ſuppoſe the world to be a ſcene of delight, wherein nothing but pleaſures are to be found, is the dream of a Sybarite: but to conclude that the world, mankind, and the brute creation, are juſt what they ought to be, is, in my opinion, thinking like a wiſe man.

VII.

"The Jews imagine that God will not for ever leave "other nations involved in this darkneſs; that a deliverer for all mankind will come; that they are "ſent into the world to proclaim him; that they "were created purpoſely to be the herald of that "mighty event, and to call upon all nations to unite "with them in expecting ſuch a deliverer."

7. The Jews have always been in expectation of a deliverer, but then he is a deliverer with regard to them, and not for us; they expect a Meſſiah, who is to bring the Chriſtians in ſubjection to the Jews; whereas we expect a Meſſiah, who is one day to unite the Jews with the Chriſtians. Their notions on this head are directly oppoſite to thoſe entertained by us.

VIII.

“ The law by which this people is governed, is in
“ all reſpects the moſt antient and moſt perfect in the
“ world, and the only one which has ever been ob-
“ ſerved in a ſociety or ſtate without interruption.
“ This Philo Judæus ſhews us in ſeveral places, as
“ does Joſephus admirably well in his writings
“ againſt Appian, wherein he proves its antiquities to
“ be ſo very remote, that even the word law was not
“ known in the moſt antient governments till above
“ a thouſand years afterwards; ſo that Homer, who
“ mentions ſo many nations, has never once mention-
“ ed the word. We may eaſily judge of the perfec-
“ tion of this law from the bare peruſal of it; it ap-
“ pearing that all things are there attended to with
“ ſuch a depth of wiſdom, equity, and judgement,
“ that the moſt antient Greek and Roman lawgivers,
“ having ſome knowledge of the ſyſtem in queſtion,
“ borrowed their principle laws from it, as appears
“ from the laws of the 12 tables, and from the other
“ evidences exhibited by Joſephus on that occaſion.”

8. Nothing can be more falſe than to aſſert, that the Jewiſh law is the moſt antient; ſince the Jews before the time of Moſes, their lawgiver, lived in Egypt, a country the moſt renowned of any in the univerſe for its laws; which were ſo wiſe, that kings were ſaid to be judged by them after death. It is no leſs falſe that the word law was not known till after Homer's time, ſince this poet expreſly mentions the laws of Minos in his Odyſſey; and moreover the word law is found in Heſiod; but admitting this word not to have been ſpecified in either of theſe authors, that would be nothing to the purpoſe. There were antient kingdoms, there were kings and judges, and conſequently there were laws. Thoſe of the Chineſe are far prior, in point of antiquity, to thoſe of Moſes.

It is equally untrue that the Greeks and Romans formed ſome laws from the Jews. This could not be in the infancy of the Roman commonwealth, it not being poſſible for them to be then acquainted with the Jews, nor could it be during its flouriſhing ſtate; for at that time they held theſe Barbarians in the utmoſt contempt, as was well known to the whole world. Obſerve how Cicero treats them in ſpeaking of the taking of Jeruſalem by Pompey. Philo himſelf acknowledges, that before the tranſlation of the Septuagint their writings were wholly unknown to other nations

IX.

" The ſincerity of theſe people is admirable, they " preſerve with the utmoſt care and affection the book " wherein Moſes tells them that they have always behaved ungratefully towards God, and that he knows " they will be ſtill more ungrateful after his death; but " that he appeals to heaven and earth whether he had " not reproached them ſufficiently for it. Finally, " that God, incenſed at their tranſgreſſions, will diſperſe and ſcatter them among all nations. That " as they had provoked him to jealouſy by ſerving " Gods that are no Gods, he alſo will provoke them " by calling a people who were not his people. " Nevertheleſs the Jews preſerve at the hazard of " their lives, this book which reflects ſo much diſhonour on them in every reſpect; an inſtance of " ſincerity that is not to be parallel'd, nor can its " root be in nature."

9. Inſtances of this ſincerity are to be met with every where, and it has its root wholly in nature. The pride of every Jewiſh individual prompts him to believe that he does not owe his deſtruction to his deteſtable politics, his ignorance of the polite arts, and his unciviliz'd diſpoſition, but that it is the wrath of God that puniſhes him. He feels a pleaſure in the reflection, that no leſs than morality were neceſſary before he could be humbled, and that his nation, tho' puniſhed by the Almighty, is ſtill his darling people.

Should a preacher go up into the pulpit, and addreſs his French congregation in the following manner: " You are a parcel of cowardly, ignorant fellows, and were beat at Hochſtet and Ramillies, merely becauſe you did not know how to make a proper defence." The preacher, I ſay, would get his brains beat out. But if, inſtead of ſo ill adviſed an harangue, he was to ſpeak thus: "You are Catholics, and as ſuch beloved by heaven. The enormity of your ſins had drawn down upon you the wrath of God, who therefore gave you up to the heretics at the battles of Hochſtet and Ramillies; but when you turned again to the Lord he bleſſed your courage at Demaen." Such a ſpeech would win him the affections of his auditors.

X.

"If there is a God, he only is to be loved, and not "the creatures."

10. It is the duty of man to love, and that with the utmoſt tenderneſs, the creatures: it is incumbent on him to love his country, his wife, and his children, and this love is ſo inherent that the Almighty forces a man in ſpite of himſelf to love them. To argue upon contrary principles, would anſwer no other purpoſe than to make men brutal and inhuman: a clear evidence of the truths of this aſſertion we have in Mr. Paſcal himſelf, who, by making a bad uſe of this principle, treated his ſiſter with great harſhneſs, and rejected her tender offers of ſervice, left he ſhould appear to love a creature: this anecdote is found in the hiſtory of his life. If ſuch was the uſe to be made of this principle, what would become of human ſociety?

XI.

"We are born unjuſt, every man thinking only "how to gratify himſelf, a circumſtance which claſhes "with order in general. Man ſhould direct his views "to the general good, and ſelf affection is the ſame of "all the diſorders which ariſe in war, polity, and "œconomy, &c."

11. This is agreeable to order in general. It would be as impoſſible for a ſociety to be founded and ſup-

port itſelf without ſelf-love, as for a perſon to attempt to get children without the deſire of coition, or to nouriſh his body with food when he has no appetite. It is the love of ourſelves that aids the love of others; it is by our mutual wants that we become uſeful to the reſt of mankind. This is the foundation of all commerce, the bond which unites men eternally to each other, and without it not a ſingle art would have been wanted, nor a ſociety even of ten perſons founded. This ſelf-love, with which nature has inſpired every animal, makes him pay a regard to that of others. The law directs this principle, and religion refines it. God might indeed, if he had thought proper, have formed creatures whoſe only object ſhould be the good of others. Had this been the caſe, merchants would have traded to the Indies merely from a charitable deſire of ſupplying the wants of others, and the maſon would have ſawed ſtone with no other view but to ſerve his neighbour. But God has ſeen fit to order things after a different manner: therefore let us not accuſe the inſtinct which he has given us, but apply it to the ſeveral uſes which he has directed.

12. The hidden ſenſe of the prophecy could not lead men into error, and none but a people ſo entirely carnal-minded could have miſtaken the ſenſe of them.

For where an abundance of bleſſings were promiſed, what beſides their own luſts could have determined them to apply theſe to the good things of this world, inſtead of theſe more durable ones hereafter?

Would it have been poſſible for the moſt ſagacious people in the world, to have underſtood them otherwiſe? They were ſlaves to the Romans; they expected a redeemer, by whoſe help they were to become victorious, and who was to make Jeruſalem formidable throughout the world. How was it poſſible for them, with the eye of reaſon only, to ſee that conqueror and that monarch in Chriſt, whom they beheld with their bodily eyes poor and crucified? How could they underſtand by the name of their chief city, a heavenly Jeruſalem, ſince the immortality of the ſoul is not once mentioned in the decalogue? How could a people, who adhered ſo ſcrupulouſly to their law, diſcover, without the help of ſupernatural light, in the prophecies, which were not their law, a God concealed beneath the form of a circumciſed Jew, whoſe new religion deſtroyed and ſet in the moſt deſpicable light circumciſion and the ſabbath, the ſacred foundations on which the Jewiſh law is built? Had Mr. Paſcal himſelf been born a Jew, he would, he muſt have fallen into the ſame errors. Once again let me repeat it: It is our duty to worſhip God, without attempting to pierce through the veil which hide his myſteries from us.

XIII.

" The time of Chriſt's firſt coming is foretold, but " that of his ſecond coming is not, and for this reaſon, " becauſe the firſt was to be private, but the ſecond " was ordained to be ſo open and conſpicuous, that " even his enemies might be compelled to acknow" ledge him.

13. The time of Chriſt's ſecond coming was foretold more clearly than even the firſt. I ſuppoſe Mr. Paſcal forgot that Chriſt, in the twenty-firſt chapter of St. Luke's Goſpel, declares himſelf thus:

" And when ye ſhall ſee Jeruſalem encompaſſed with armies, then know that the deſolation thereof is nigh.—And there ſhall be ſigns in the ſun, and in the moon, and in the ſtars; and upon the earth diſtreſs of nations, with perplexity, the ſeas and the waves roaring. For the powers of heaven will be ſhaken.—And then they ſhall ſee the ſon of man coming in a cloud, with power and great glory."

What clearer prophecy can we have with regard to Chriſt's ſecond coming? But if this be an event that is yet to come, it would argue great preſumption in us to inquire of Providence concerning it.

XIV.

"The Meſſiah, in the opinion of the carnal Jews, is
"to be a powerful temporal prince, whereas the carnal
"Chriſtians think he is come to releaſe us from our
"*love to God*, and to give us ſacraments, which, with-
"out our concurrence, ſhall *operate all powerfully*
"upon us; but neither of theſe is the Chriſtian or
"Jewiſh religion."

14. This article is rather of a ſatyrical fling than a Chriſtian reflection. It is plain, that the Jeſuits are levelled at here: but what Jeſuit was ever known to aſſert, that Chriſt came into the world to releaſe us from our *love to God?* The controverſy concerning the love of God is a mere conteſt about words, like moſt of theſe ſcuribifical quarrels, whence ſuch ſtrong animoſities, ſuch fatal calamities, have ſprung. There is alſo another defect in this article; I mean the author's ſuppoſing, that the expectation of a Meſſiah, was conſidered by the Jews as an article of their religion; whereas it was only a conſolatory reflection, in which they indulge themſelves. The Jews hoped for a deliverer to come, but then they were not obliged to believe this as an article of faith. Their whole religion was compriſed in the book of the law, and the prophets were never conſidered by them as lawgivers.

XV.

"To examine the prophets with effect we muſt
"underſtand them: for if we believe they have but
"one meaning, it is certain the Meſſiah is not yet
"come; but if they have two meanings, he certainly
"came in Chriſt Jeſus."

15. The Chriſtian religion, which is founded on truth itſelf, does not ſtand in need of doubtful proof or evidences; but if any circumſtance is capable of ſhaking the foundation of that holy, that rational religion, it is this opinion of Mr. Paſcal. He aſſerts, that every part of the ſcripture bears a double meaning; but a perſon who ſhould be ſo unhappy to be an unbeliever,

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believer, might argue thus with him. A perſon who delivers himſelf in terms that bear a double interpretation, muſt have an intention to impoſe upon us, and ſuch double dealing is puniſhable by the laws. How, therefore, can you, without bluſhing, admit thoſe very things in God, for which mankind are adjudged infamous, and are puniſhed. Nay, in how contemptible a light do you conſider, with what indignation do you treat the oracles of the Heathens, merely on account of their being always ſuſceptible of a double interpretation? If a prophecy is accompliſhed in its literal ſenſe, will you take upon you to aſſert that ſuch prophecy is falſe, becauſe it is verified only as to the letter, and will not anſwer in the myſtical ſenſe that may be affixed to it? Certainly you could not, without being guilty of great abſurdity. How then can a prophecy, which never has been really accompliſhed, become true in a myſtical ſenſe? Or will you ſay, that you cannot make it falſe if it is true, but that if it is falſe you can make it true? This is certainly very ænigmatical, and after all we ſhall find it beſt to abide by faith in theſe matters, as the ſureſt way of ending the diſpute.

XVI.

"The infinite diſtance between the body and ſpi-
"rit, points out the infinitely more infinite diſtance
"between ſpirit and love, this latter being ſuperna-
"tural.

16. We may reaſonably ſuppoſe Mr. Paſcal would never have introduced ſuch confuſed ſtuff into his work, had he taken the pains or leiſure neceſſary to compoſe it.

XVII.

"Such particulars as are moſt apparently weak, are
"found to have great ſtrength by thoſe who conſi-
"der things in a proper light:. for inſtance, the two
"genealogies given us by St. Mathew and St. Luke.
"It is evident this was not done by confederacy."

17. The editors of Paſcal's thoughts ought undoubtedly to have ſuppreſſed this reflection, the bare explanation of which will perhaps be of prejudice to religion. Of what uſe can it be to declare thoſe genealogies, which are fundamental points of the Chriſtian religion, claſh with each other, unleſs a method be at the ſame time pointed out to reconcile them? An antidote ſhould have been adminiſtered at the time with the poiſon. What ſhould we think of a lawyer who was to ſay, My client contradicts himſelf, but theſe apparent weakneſſes will be found of great ſtrength by thoſe who conſider things in their proper light? Or what opinion ſhould we entertain of two witneſſes, whoſe depoſitions contradict each other? Should we not be apt to ſay, You do not agree in your evidence, but certainly one of you is miſtaken?

XVIII.

" Let no one, therefore, reproach us with want of " light, ſince we make profeſſion of it; but let them " acknowledge the truth of religion, even in the obſcurity of it, and in that indifference which we ſhew " with regard to gaining light into it.

18. What odd characteriſtics of truth are here brought us by Mr. Paſcal? What then are the characteriſtics of falſehood? Can it be enough for a man, deſirous of being believed, to ſay, I am obſcure, I am unintelligible? It would ſhew much more judgement to offer only the light of faith to the eye, in the room of ſuch abſtruſe ſtrokes of erudition.

XIX.

" If there was but one religion, God would be too " manifeſt."

19. How! do you ſay, that if there was but one religion, God would be too manifeſt? You ſurely forget that you tell us in every page, that the time will come, when there will be but one religion. According to your reaſoning, God will then be too manifeſt.

XX.

“ I affirm, that the Jewiſh religion did not conſiſt
“ in any of theſe things, but only in the law of God,
“ and that God rejected and condemned all other
“ things.’

20. What! did God reject and condemn all thoſe things, the performance of which he himſelf had ſo ſtrictly and particularly enjoined the Jews? Would it not be rather more juſt to aſſert, that the law of Moſes conſiſted in love, and was life? The reducing all things to *the law of God*, argues not ſo much a love for God, as the hatred which every Janſeniſt bears to his Moliniſt neighbour.

XXI.

“ The moſt important act in life is the choice of a
“ trade, and yet chance generally determines on this
“ occaſion. Cuſtom makes ſoldiers, bricklayers, and
“ the like.”

21. How ſhould ſoldiers, bricklayers, and mechanics, in general be governed, but by the things we call chance or cuſtom? It is only in the acts of genius that we find a ſelf-impulſe, but as to thoſe trades or profeſſions, which all men are capable of exerciſing, it is not only juſt but natural, that cuſtom ſhould determine on thoſe occaſions.

XXII.

“ Let every man examine his own thoughts, and he
“ will find that they are always buſied on things paſt,
“ and on thoſe to come. We ſcarce ever reflect on
“ the preſent; and if we ever do reflect on it, it is
“ only with a view to borrow light therefrom, in order
“ for our diſpoſal of futurity. The preſent is never
“ our aim; paſt and preſent are our means, futurity
“ only is our object.”

22. It is falſe to ſay, that we do not think of the preſent, we think of it while we are engag’d in the ſtudy of nature, and while we are performing all the functions of

life; we alſo think greatly of the future. Let us therefore thank the author of nature for informing us with that inſtinct which is for ever directing us to futurity. The moſt valuable treaſure poſſeſſed by man, is that hope which ſoftens our cares, and which, while we are enjoying preſent bleſſings, paints future ones in the imagination. Were mankind ſo unhappy as to employ their minds only on the time preſent, no perſon would ſow, build, plant, or make the leaſt proviſion in any reſpect, but would be in want of all things in the midſt of this falſe enjoyment. How could ſo ſublime a genius as Mr. Paſcal inſiſt on the truth of ſo falſe a propoſition! Nature has ſo ſettled things, that every man is to enjoy the preſent by ſupporting himſelf with food, by getting children, by liſtening to agreeable ſounds, by employing his faculty of ſeeing and feeling; and that at the inſtant of his quelling theſe ſeveral conditions, and even in the midſt of them, he reflects on the morrow, without which he would die for want to-day.

XXIII.

"But on examining this matter more attentively, "I found, that the total diſregard which men ſhew "to the procuring themſelves repoſe and tranquillity, "and to the living inwardly, ſprings from a cauſe "which is but too real; I mean from the natural in- "felicity of our weak, our mortal condition, which is "ſo very wretched, that nothing is able to comfort us "at the time that we are not prevented by any "thing from reflecting on it, and that we behold no- "thing but ourſelves.

23. The expreſſion, *we behold nothing but ourſelves*, conveys nothing intelligible to the mind. What would a man be, who ſhould remain in a ſtate of inactivity, and be ſuppoſed to contemplate himſelf? I affirm ſuch a perſon would not only be an ideot, an uſeleſs member of ſociety, but I will alſo as boldly affirm, that no ſuch man can ever exiſt; for what can we have to contemplate? His body, his feet, his hands, his five ſenſes?

He either muſt be an idiot, or he would make a proper uſe of theſe. Would there ſtill remain his faculty of thinking for him to contemplate? But he cannot contemplate that faculty without exerciſing it. He will either think on nothing, or on thoſe ideas that are already preſent to his imagination, or he will form new ones: now all his ideas muſt come from without. Thus is he neceſſarily employed, either about his ſenſes, or about his ideas; conſequently, he, on this occaſion, is either out of himſelf, or an idiot. Once again, it is impoſſible for human nature to coutinue in this ſuppoſed lethargy: it is abſurd to imagine it, and fooliſh to pretend to it. Man is born for action as the fire tends upwards, and a ſtone downwards. Not to be employed, and not to exiſt, is one and the ſame thing with regard to man. The whole difference conſiſts in his employments, as they are either calm or tumultuous, dangerous or uſeful.

XXIV.

" Mankind are informed with a ſecret inſtinct, which prompts them to ſeek after amuſement and employment from without, ariſing from a ſenſe of their perpetual miſery; and they are informed with another inſtinct, ariſing from the greatneſs of their firſt nature, which teaches them that happineſs is found no where but in repoſe."

24. As this ſecret inſtinct is the firſt principle and the neceſſary foundation of ſociety, it proceeds from the kindneſs of our Creator, and is an inſtrument of our felicity rather than a ſenſe of our miſery. I know not how our firſt parents paſſed their time in paradiſe, but if each of them had made their own perſon the ſole object of their reſpective thoughts, the propagation of mankind would have been extremely dubious. Can any thing be more abſurd than to ſuppoſe, they were endued with perfect ſenſes, that is, with perfect inſtruments for action, only to paſs their whole lives in contemplation? And how whimſical it is to ſuppoſe, that

thinking men ſhould imagine, that idleneſs enobles, and that action degrades human nature!

XXV.

" When therefore Cineas told Pyrrhus, who propoſed to repoſe himſelf and enjoy his friends, after he ſhould have conquered a great part of the world, that he had better haſten his felicity, by enjoying that repoſe for the preſent, rather than undergo ſuch a ſeries of fatigues, in order to obtain it in future, it would (I ſay) have been very difficult for Pyrrhus to put this advice in execution; nor was it much more juſt and rational, than the deſign of this ambitious youth. They both imagined that it was poſſible for man to draw contentment ſolely from himſelf, and from preſent bleſſings, without filling the void of his heart with imaginary hopes, which is falſe, for Pyrrhus could not be happy, neither before nor after he had conquered the world."

25. This example of Cineas does well enough in Boileau's ſatyrs, but not in a philoſophical treatiſe. A wiſe king may be happy at home, and the inſtance of Pyrrhus's madneſs or folly has nothing to do with the reſt of mankind.

XXVI.

" We ought therefore to confeſs, that man is ſo very unhappy, that he would grow tired of himſelf, without any external cauſe to render him ſo, merely from the ſtate of his condition."

26. On the contrary, man is ſo happy in this particular, and we are ſo much obliged to the author of nature, that he has made uneaſineſs inſeparable from inactivity, in order to compel us by that means to be uſeful both to our neighbours and ourſelves.

XXVII.

" See yonder man! how comes it to paſs, that he, who has lately loſt his only ſon, who involved him

“ in a vexatious law-ſuit, and was but this morning
“ in a ſtate of deſpair, ſeems now ſo perfectly eaſy and
“ unembarraſſed? There is nothing wonderful in all
“ this. His eye is at this inſtant curiouſly examining
“ which way it will be poſſible for that ſtag, which
“ the hounds have been cloſely purſuing theſe ſix
“ hours, to eſcape. Man, however oppreſſed with
“ grief, if he can but be perſuaded to engage in ſome
“ diverſion, is happy during that time.”

27. This man acts wiſely, diverſions being a more infallible remedy againſt Grief, than the Jeſuit's bark in fevers. Let us not cenſure Nature, for ſhe is ever ready to indulge us with any aſſiſtance.

XXVIII.

“ Let us ſuppoſe a number of men chained toge-
“ ther, and all ſentenced to die, ſome of them being
“ daily executed in preſence of the reſt, the wretched
“ ſurvivors behold their own condition in that of their
“ fellow priſoners, and gazing upon each other,
“ overwhelmed with ſorrow, and loſt to all hope, ex-
“ pect their turn to be next; this is an exact image
“ of mankind.”

28. This compariſon is moſt certainly falſe. A number of miſerable creatures bound in chains and ſucceſſively called forth to execution, are unhappy not only becauſe they ſuffer, but becauſe they ſuffer what other men do not. The natural condition of man is not to be either chained or murdered; but all men, like animals and plants, are ſent into the world to grow, and live a certain period, to beget their like and die. Satyriſts may, if they pleaſe, take all opportunities of exhibiting man in his worſt light; but if we will make the ſmalleſt uſe of our reaſon, we ſhall find ourſelves conſtrained to own, that of all animals, man is the moſt perfect, the happieſt, and (comparatively ſpeaking) the longeſt lived.

Therefore, far from wondering at, or complaining of, the infelicity or ſhortneſs of life, we ought, on the contrary, to wonder that our happineſs ſhould be ſo great, and of ſo long duration, and felicitate ourſelves on that prerogative. To reaſon only philoſophically, I will venture to obſerve, that he, who ſhall aſſert that we ought, from our nature, to be in a better condition than we actually are, ſhews a great ſhare of pride, and no leſs temerity of judgment.

XXIX.

" For, in a word, if mankind had not been cor-
" rupted, he would enjoy the knowledge of truth
" and felicity in an aſſured manner, &c. ſo evident
" is it that we have once been in a ſtate of perfection,
" from whence we are fallen."

29. It is certain both from faith and revelation, which are far ſuperior to human comprehenſion, that we are fallen; but it is by no means manifeſt from reaſon. For I would deſire to know, whether God could not, without derogating from his juſtice, have created man ſuch as he now is, and even whether he did not create him to be what he now is? May not the preſent ſtate in which man is, be conſidered as a bleſſing? What reaſon have we to expect any thing more from God? Who told us, that our being required greater knowledge or happineſs? Who told us we could bear with more? Are you ſurprized that God made man ſo weak, ſo ignorant, and ſo wretched, and not aſtoniſhed, that he did not make us more ſo? You complain of a ſhort life full of misfortunes. Return thanks to the Creator who did not make it more circumſcribed and miſerable. By your reaſoning it ſhould ſeem, that every man has reaſon to accept the duty, the metaphyſicians excepted, who reaſon on original ſin.

XXX.

" Original ſin is a ridiculous notion in the eyes of
" mankind, and is accounted as ſuch."

30. How contradictory! a little before you have ſaid, that the reality of original ſin is evident, becauſe (to uſe your own words) every thing declares it to us. But how can it at one and the ſame time be ridiculous, and yet demonſtrable by reaſon?

XXXI.

" The ſages amongſt the heathens, who declared
" there was but one God, were perſecuted ; the Jews
" were hated, and the Chriſtians held in deteſta-
" tion."

31. They were ſometimes perſecuted juſt as a man would be who, in this age, ſhould teach the worſhip of God independently from the eſtabliſhed worſhip. Socrates was not condemned for ſaying, *there was but one God*, but for cenſuring the exterior worſhip of his country, and for having raiſed againſt himſelf, very unſeaſonably, a ſet of powerful enemies. With regard to the Jews, they were hated, not becauſe they believed only in one God, but becauſe they bore a ridiculous hatred to other nations ; becauſe they were barbarians, who cruelly butchered their vanquiſhed enemies ; and becauſe this ſwelling, this ſuperſtitious and ignorant people, who were utter ſtrangers to the polite arts and trades, had a contempt for the moſt civilized and refined nations. As to the Chriſtians, the Heathens have an averſion to them, becauſe they endeavoured to deſtroy their religion and government ; in which they ſucceeded at laſt, in like manner as the Proteſtants have got poſſeſſion of theſe very countries, where they were for many years perſecuted and butchered.

XXXII.

" What a number of ſtars have been diſcovered by
" teleſcopes, which were hid from the philoſophers
" of antiquity ! ſome have boldly impeached the
" ſcriptures, on account of what is ſaid in ſo many
" places of the vaſt number of ſtars ; becauſe, ſay
" they (very modeſtly) we know there are but one
" thouſand and twenty-two."

32. It is certain, that the ſacred writers, in matters relating to phyſics, always adapted themſelves to the received notions. Thus they ſuppoſed the earth to be fixed, the ſun to move, &c. It is not in any man-

ner from aſtronomical definement, that they aſſert the ſtars to be numberleſs, but merely to ſuit themſelves to vulgar capacities. And, indeed, though our ſight diſcovers but one thouſand and twenty-two ſtars, nevertheleſs, when we look attentively upon the ſky, the dazzled eye imagines it beholds a numberleſs multitude. The ſacred penmen, therefore, expreſs themſelves agreeably to this vulgar notion, their compoſitions not being tranſmitted to mankind with a view to make them naturaliſts. And it is more than probable, that God never revealed to Habakkuck, to Baruch, or to Micah, that an Engliſhman, named Flamſtead, would one day inſert in his catalogue, upwards of ſeven thouſand ſtars, diſcovered by the aſſiſtance of teleſcopes. Obſerve, I beſeech you, what an inference might be drawn from Paſcal's thought. If the ſacred writers have really ſpoken of ſuch a great number of ſtars, from a knowledge of their cauſe, they muſt then have been phyſically inſpired: But how then could ſuch great naturaliſts ſay, that the moon ſhone at noon-day upon Aſkalon, and the ſun ſtood ſtill upon Gabaon in Paleſtine? Could they have aſſerted that the grain muſt rot in the ground, before it produces corn, and an hundred other like abſurdities? Hence then we are to conclude, that moraliſts, and not natural philoſophers, ought to be the object of our ſcriptural reſearches, and that the Bible is intended to make Chriſtians, and not philoſophers.

XXXIII.

" Can it be called courage in a dying man, to de-
" fy, in his laſt moments, an omnipotent and ever-
" laſting God?"

33. This never happened, and no man, but in the height of a delirium, could ſay, I believe in God, and I defy him.

XXXIV.

" I willingly credit thoſe hiſtories, the witneſſes to which gave themſelves up to death."

34. The difficulty is not only to know whether we ought to give credit to witneſſes, who ſuffer death in defence of their ſentiments (as ſo many enthuſiaſts have done) but likewiſe whether ſuch witneſſes really laid down their lives on ſuch account; whether the teſtimony for which they ſuffered, has been really tranſmitted to us; and whether they actually lived in the countries where they are ſaid to have died. Whence comes it that Joſephus, who was born about the time of Chriſt's death; Joſephus, who hated Herod; Joſephus, who was but faintly attached to the Jewiſh principles, does not once mention any of theſe particulars? This is what Mr. Paſcal would have unravelled with ſucceſs.

XXXV.

" There are two extremes in the ſciences which
" border cloſe upon each other. The firſt is the na-
" tural ignorance in which all men are born. The
" other extreme is that to which great ſouls attain,
" who, after having acquired all that is poſſible for
" man to know, find they know nothing, and meet
" in the very point of ignorance from whence they
" ſet out."

35. This thought has all the air of ſophiſtry, and its falſity conſiſts in the word ignorance, which is taken in two different ſenſes. One who can neither read nor write is ignorant; but a mathematician, though he be unacquainted with the occult principles of nature, is not ſo ignorant as when he firſt began to learn to read. Though Sir Iſaac Newton could not tell why a man can move his arm at pleaſure, this did not make him leſs knowing in other particulars. A perſon who is ignorant of the Hebrew language, but ſkilled in the Latin, is learned in compariſon of one who underſtands no tongue but his own.

XXXVI.

" A man cannot be called happy becauſe diver-
" ſions give him pleaſure; theſe coming from with-
" out, and conſequently being dependent, and as
" ſuch are liable to be diſturbed by a thouſand acci-
" dents,

" dents, which each form as many unavoidable " afflictions."

36. He might with equal truth have ſaid, that a man is not unhappy, becauſe he is overwhelmed with grief, for grief comes from without. That man is actually happy who enjoys pleaſure, and this pleaſure can ariſe no otherwiſe than from without. All our ſenſations and ideas can reſult only from external objects; in like manner as our bodies can receive nouriſhment no otherwiſe than by taking in foreign ſubſtances, in order for their being changed into, or aſſimilated with our own.

XXXVII.

" Extreme wit is ſaid to border as near upon folly " as extreme imperfection. Mediocrity only is ac" counted good."

37. It is not the extremes of wit or genius, but their extreme vivacity and volubility, which are ſaid to border upon folly. The extremes of wit or genius, are extreme juſtneſs, extreme delicacy, extreme extent of conception, all which are diametrically oppoſite to folly. An extreme defect of genius is the want of conception; an abſolute vacuity, is not folly, but ſtupidity. Folly is a diſorder in the organs, which makes us perceive ſeveral objects too quick, and fixes the imagination upon one in particular with too great intenſeneſs and violence. Neither is it mediocrity which is only accounted good, but the keeping clear of the two oppoſite vices, is what we call the juſt mean, not mediocrity. I have made this remark, as well as ſome others of the ſame kind, only to convey clear and preciſe ideas of things, and with a view rather to enlighten than cavil.

XXXVIII.

" If our condition was truly happy, it would not be " proper to divert us from thinking on it."

38. The ſtate of our condition is directly this, to reflect on thoſe outward objects to which we bear a neceſſary relation. It is falſe to ſay, that it is poſſible for a man to be diverted from thinking on the condition of human nature; for to what object ſoever he applies

his thoughts, he applies them to ſomething which is neceſſarily united to human nature. And once again, for a man to reflect, or think on himſelf abſtractedly from natural ſurveys, is to think on nothing; I ſay on nothing at all, and let this be well obſerved.

People, ſo far from preventing a man from thinking on his condition, are ever entertaining him with the pleaſures of it. To a ſcholar we talk of learning and fame; to a prince, of matters relating to his grandeur; and with all men we make pleaſure the ſubject of converſation.

XXXIX.

"The high and the low, the mighty and the mean, "are all ſubject to the ſame uneaſineſſes and paſſions. "But ſome are at the top of the wheel, and others "near the centre; theſe are conſequently leſs agitated "by the ſame motions."

39. It is falſe to aſſert, that thoſe in a low condition are leſs agitated than ſuch as are in a higher ſphere of life; on the contrary, their grief is the more poignant as they are leſs provided with remedies againſt it. Of an hundred perſons, who lay violent hands upon themſelves in the City of London, ſeventy will be found to be mean perſons, and ſcarce one of high rank. The compariſon of the wheel, though ingenious, is falſe.

XL.

"Mankind are not taught to be honeſt, though "they are taught every thing elſe; and yet there is "nothing in which they pride themſelves ſo much, "as in a knowledge of that which they are not "taught."

40. Perſons are taught to become honeſt men, otherwiſe few would be ſo. Should a father permit his child, during his infancy, to pocket every thing that came in his way, at fifteen he would take to the road. Should he be proud for his dexterity in telling a lie, he would turn out a knight of the poſt; and was he to be indulged in the free exerciſe of his luſtful appetites, he would certainly become an abandoned debauchee. Mankind are taught all things, even virtue and religion.

XLI.

“ How ſtupid was it in Montaigne to draw his own
“ picture; and this not occaſionally, and in oppoſition
“ to his own maxims (as every man may make
“ a ſlip) but agreeable to his own maxims, and as his
“ firſt and principal object; for to vent trifles merely
“ by chance, and thro' frailty, is a common evil;
“ but to vent them deſignedly, and ſuch as thoſe we
“ are ſpeaking of, is inſufferable.”

41. Say rather how charming a thought it was in Montaigne, in drawing ſo natural a picture of himſelf! for mankind was the original he copied. Had Nicole and Malebranche always made themſelves their ſubject, they would not have ſucceeded. But the private gentleman in the reign of Henry III. who is learned in an age of ignorance, and a philoſopher amidſt a herd of enthuſiaſts, who preſents to us our follies and weakneſs under his own character, will ever continue to be beloved by us.

XLII.

“ When I conſidered whence it ſhould come to
“ paſs, that people give ſo much credit to ſuch
“ numbers of quacks, who boaſt their being poſſeſſed
“ of infallible noſtrums, ſo as frequently to truſt
“ their lives in their hands, I imagined the true cauſe
“ of this to be, that there were ſuch things as true
“ medicines in the world; for it would be impoſſible
“ that there ſhould be ſo many ſpurious ones, or ſo
“ much credit given to them, if there were none
“ genuine. Had there never been any ſuch, and
“ that all diſeaſes in general had been incurable, it is
“ impoſſible mankind could have imagined there were
“ any in nature; and ſtill more that ſo many multitudes
“ of people ſhould have given credit to thoſe
“ who boaſted their being poſſeſſed of ſuch medicines.
“ Was a perſon to pretend that he had got a ſecret
“ which would preſerve people from the grave, no
“ one would believe him, becauſe there have been
“ no examples of this. But as a great number of medicines
“ have been found genuine, from the experi-

"ence of the greateſt men, this circumſtance was the "belief of mankind. For as the thing could not be "denied in general, becauſe ſome particular effects "have been found true, the vulgar, who have not "the capacity to diſcern among thoſe which are the "true ones, therefore give credit to them all indiſ"criminately. In like manner, the reaſon why ſo "many falſe effects of the moon are believed, is, be"cauſe there are ſome true ones, ſuch as the ebbing "and flowing of the ſea.

"Thus it ſeems evident to me, that the ſole reaſon "why there are ſo many falſe miracles, falſe revela"tions and witchcrafts, is, becauſe there are true "ones."

42. The ſolution of this problem is very eaſy: ſome extraordinary effects in nature having appeared, they were by artful impoſters made to paſs for miracles: ſome maladies being obſerved to be worſe while the moon was in the full, hence a parcel of ſilly people imagined, that the moon being in the full was the cauſe of thoſe diſorders growing worſe. A ſick perſon, who was already in a fair way of recovery, eats ſome craw-fiſh for ſupper, the next day he is better; therefore it was concluded, that craw-fiſh were purifiers of the blood, and eſpecially becauſe they are red when boiled.

In my opinion mankind are not obliged neceſſarily, in order for their auditing what is fact, to be acquainted with what is true: a thouſand falſe influences were aſcribed to the moon, before we had the leaſt conception of the true reaſon of the ebbing and flowing of the ſea. The firſt man, who found himſelf ſick, eaſily gave credit to the firſt quack he met with. No one ever ſaw a hobgoblin or a wizard, and yet many believed there were ſuch beings: no man was ever an eye witneſs to the tranſmutation of metals, and yet thouſands have been ruined by their believing in what is called the philoſopher's ſtone. Did the Greeks, the Romans, or other heathen nations, give credit to the numberleſs falſe miracles which were exhibited to them for no other reaſon but becauſe they had been ſpectators of true ones?

XLIII. "The

XLIII.

" The land ſerves as a mark to the mariners, but
" where ſhall we find ſuch a rule in morality ?"

43. In this ſingle maxim, admitted by all nations, " Do as you would be done by."

XLIV.

" Theſe prefer death to the living in peace, others
" prefer death to war. Every opinion may be pre-
" ferred to life, the love of which appears ſo ſtrong
" and natural."

44. Ferox gens nullam eſſe vitam ſine armis putant, ſays Tacitus, in ſpeaking of the Catalans. This fierce people think their life thrown away if not ſpent in arms. But there is no people of whom it has been and may be ſaid, *They prefer death to war*.

XLV.

" The more diſcernment any perſon has, the
" greater number of perſons will be found who are
" originals in their way. The vulgar cannot perceive
" the difference between man and man."

45. Very few men can juſtly boaſt an original character, as moſt people ſquare their conduct, their thinking and their feeling, according as they have been influenced by education : nothing is more rare than a genius who ſtrikes out a new path for himſelf. But among the croud of men who travel in company, each of them has ſome little difference in his gait, which is perceived by thoſe only who have a piercing eye.

XLVI.

" Death is more eaſy to be ſupported without
" thinking of it, than the reflection on death when
" out of danger."

46. We cannot ſay that man bears death very eaſily or uneaſily when he does not reflect at all upon it. He who feels nothing bears nothing.

XLVII.

" All our reaſoning terminates in yielding to ſen-
" ſation."

47. Our reaſoning muſt yield to ſenſation, in matters of taſte, not in thoſe of knowledge.

XLVIII.

" Thoſe who judge of work by rule, are, with
" reſpect to other men, like thoſe who have a watch,
" in compariſon with thoſe who have none. The
" one ſhall ſay we have been here theſe two hours;
" the other, we have been here but a quarter of an
" hour. I look upon my watch, and ſay to the former,
" you are tired; and to the latter, you think the
" time very ſhort."

48. In works of taſte, in muſic, poetry, and painting, taſte ſerves as a watch, and that man who judges of them only by rule judges wrong.

XLIX.

" Cæſar, in my opinion, was too old to ſet about
" the conqueſt of the world. This was an amuſe-
" ment that ſuited well enough with Alexander,
" who was a young man, whoſe impetuoſity it was
" difficult to check; but Julius Cæſar ſhould have
" been more compoſed."

49. 'Tis vulgarly ſuppoſed, that Alexander and Julius Cæſar left their reſpective countries with a deſign to make the conqueſt of the world, but this was far from being the caſe. Alexander ſucceeded his father Philip as generaliſſimo of the united forces of Greece, and was appointed chief of the juſt enterprize, which the Greeks formed to revenge the injurious treatment they had met with from the Perſian monarch. He defeated the common enemy, and puſhed his conqueſts as far as India, becauſe Darius's kingdoms extended ſo far; in like manner as the duke of Marlborough, had he not been ſtopped by marſhal Villars, would have marched to Lyons. With regard to Julius Cæſar, he was one of the chief perſonages of the Roman commonwealth. He quarrelled with Pompey as the janſeniſts do with the Moliniſts; on which occaſion they endeavoured to cut one another's throats. But a ſingle battle, in which leſs than ten thouſand men fell, decided the conteſt at once. Beſides, Mr. Paſcal's reflection may poſſibly be falſe in many reſpects.

ſpects It was neceſſary that Julius Cæſar ſhould have lived to the age he did, in order for him to get the better of all the intrigues which were formed againſt him; and 'tis ſurprizing that Alexander, when ſo young, ſhould have conceived pleaſures for the ſake of engaging in ſo laborious and painful a war.

L.

" Man is neither an angel nor a brute; and the " misfortune is, that he who attempts to act the an- " gel plays the brute."

50. The man who endeavours to deſtroy the paſſions, inſtead of regulating them, attemps to act the angel.

LI.

" 'Tis whimſical enough to conſider, that there " ſhould be men in the world (thieves for inſtance) " who, having bid defiance to all the laws of God and " man, form to themſelves a ſet of laws, to which " they pay the moſt implicit obedience."

51. This reflection is more uſeful than whimſical, as it proves, that no ſociety of men can ſubſiſt a ſingle day without rules or laws. It is with ſocieties of men as with games, there is no one without its rules.

LII.

" A horſe does not endeavour to make himſelf ad- " mired by his companion. We indeed perceive thoſe " beaſts fired with ſome kind of emulation when run- " ning a race; but this is of no farther conſequence, " for when they are got together in the ſtable, that " horſe, which is leſs agreeably ſhaped than the other, " will not on that account yield his oats to him. But " it is different with mankind; their virtue is not ſa- " ſatisfied with itſelf, and they are not contented un- " leſs they can reap ſuch a benefit from it as may be " diſadvantageous to others."

52. The man, who is leſs well ſhaped than another, will not give up his bread to him for that reaſon, but

the ſtronger diſpoſſeſſes the weaker of it. Among brutes and among men, the ſtrong prey upon the feeble. Mr. Paſcal is doubtleſs very right in ſaying, that what particularly diſtinguiſhes men from brutes is, that he ſeeks the approbation of thoſe of his own ſpecies, and that this talent is the ſource of every talent and virtue.

LIII.

"If man was to begin by ſtudying himſelf, he
"would find how difficult it is for him to proceed farther. How can it be poſſible for a part to know
"the whole? He will perhaps aſpire to acquaint himſelf at leaſt with thoſe parts, to which he himſelf
"bears a proportion. But all the parts of the world
"bear ſuch a relation one to the other, and are ſo
"connected that I am of opinion 'tis impoſſible to
"know one without the other, and without the
"whole."

53. It would not be proper to divert man from ſearching after thoſe things which may be of advantage to him from this reflection, that it is impoſſible for him to know all things.

Non poſſis oculo quantum contendere Lynceus;
Non tamen idcirco contemnas lippus inungi.

Hor. Ep. I. Lib. I.

We are acquainted with a great number of truths, and have diſcovered a multitude of uſeful inventions. Let us be eaſy, tho' we may not know the relation which may be between a Spider and Saturn's ring; and let us confine our reſearches within the ſphere of our comprehenſion.

LIV.

"If thunder always fell in vallies, poets, and thoſe
"who are able to reaſon only on things of this na-
"ture, would be at a loſs for proofs."

54. A ſimile is our proof, either in verſe or proſe: in poetry it ſerves as an embelliſhment, and in proſe

it illuſtrates things and renders them more forcibly ſtriking. Thoſe poets, who have compared the misfortunes that befel heroes and great men to the thunder, that ſtrikes and rends the mountains, would make quite oppoſite compariſons if the oppoſite happened in nature.

LV.

"It is owing to a particular caſt of mind and com-
"poſition of body, that philoſophers have confounded
"the ideas of things, and aſcribed to the body things
"which relate only to the mind; and to the mind
"ſuch as ſuit the body only."

55. Did we truly know what the mind is, we might then juſtly complain of philoſophers, for aſcribing ſuch things to it as are quite foreign thereto; but we are not acquainted either with the mind or body; we have not the leaſt idea of the one, and but very imperfect notions concerning the other; conſequently we are not able to ſettle their reſpective limits.

LVI.

"As we ſay *poetical beauty*, we likewiſe ought to
"ſay *geometrical* and *medicinal* beauty, and yet we
"do not ſay ſo; the reaſon is, we know very well
"what is the object of geometry, and what is the
"object of phyſic; but we do not know what that
"is, in which the charm of beauty conſiſts, which is
"the object of feeling. We do not know what this
"natural model is, which we ought to imitate, and
"for want of this knowledge, we have invented and
"adopted certain odd terms, ſuch as *golden age*, *mi-*
"*racle of our fine fatal laurel*, *beautiful ſtars*, &c.
"and this jargon is called poetical beauty; but was
"any perſon to figure to himſelf a woman, dreſſed
"after this model, he would ſee a handſome young
"lady cover'd with looking-glaſſes, and bound in
"tinſel chains."

56. This is very falſe. We ought not to ſay geometrical beauty, nor medicinal beauty, becauſe a theorem and a purge do not affect the ſenſes in an

agreeable manner; becauſe we give the name of beauty to thoſe things only which charm the ſenſes, as muſic, painting, eloquence, poetry, regular architecture, &c. The reaſon given by Mr. Paſcal is equally falſe with his reflection. He very well knows what it is that forms the object of poetry. It conſiſts in painting with ſtrength, clearneſs, delicacy and harmony. Poetry is harmonious eloquence. Mr. Paſcal muſt have had very little taſte, to ſay that *fatal laurel*, *beautiful ſtar*, and ſuch like ſtuff, are practical beauties; and the editors of his Thoughts muſt have been very little verſed in polite literature, otherwiſe they would not have printed a reflection ſo unworthy of its illuſtrious author.

LVII.

" No one is thought to underſtand poetry, who
" does not put on the badge of a poet; nor to be
" expert in the mathematics, who has not the ſtamp
" of a mathematician: but the real honeſt man wears
" no badge."

57. By thus reaſoning, it would be as bad to have a profeſſion, or a diſtinguiſhed talent, to excel in it. Virgil, Homer, Corneille, Newton, and the marquis d'Hoſpital, wore badges of the ſtudies they followed with ſuch ſucceſs. Happy is he who ſucceeds in any particular art, and at the ſame time is acquainted with others.

LVIII.

" The common people have in general a very juſt
" taſte, an inſtance of which is in their preferring
" public ſports, hunting, &c. before poetry, and the
" politer arts."

58. It would ſeem as if it had been propoſed to the people to chuſe a game at bowls, or to make verſes. But this is not the caſe. Thoſe, whoſe organs are more groſsly formed, ſeek after thoſe pleaſures in which ſentiment has the leaſt ſhare; while, on the other hand, thoſe of delicate ſenſations wiſh for the more refined pleaſures of the mind.

LIX.

" Tho' the univerſe ſhould fall upon man and " cruſh him to death, yet would man be ſtill more " noble than that which deſtroyed him; becauſe he " is conſcious of the advantage the univerſe has " over him, and that he is about to die, whereas the " univerſe knows nothing of this."

59. What is here meant by the word noble? It is true indeed, that Thought is a different kind of thing from the ſun; but can it be proved, that an animal, becauſe he is endowed with a few thoughts, is more noble than the ſun, which animates all that we behold in nature? Is it for man to decide, who is both judge and culprit? We ſay that one performance is ſuperior to another, when it coſt the workman more pains, and is more evidently uſeful; but did it coſt the creator leſs pains to make the ſun than to mould a little animal about 5 feet high, who reaſons ſometimes well and ſometimes ill? Which of the two is moſt uſeful in the univerſe, this animal, or the planet that beſtows light and heat on ſo many ſurrounding worlds? Or again, how comes it to paſs, that a few ideas received into the brains ſhould be preferable to the material univerſe?

LX.

" Fix upon what condition of life you pleaſe, and " add to it all the conveniences, the bleſſings, and the " pleaſures of life, all that can ſeem moſt likely to " ſatisfy a human being, yet, if the perſon who is " placed in this ſtate is without occupation or amuſe" ment, and left to the reflection of what he really is, " this inſipid felicity will ſoon grow irkſome."

60. How can we place a man in the midſt of all the conveniencies, the bleſſings and pleaſures of life, and at the ſame time leave him deſtitute of occupation and amuſement? Is not this a palpable contradiction?

LXI.

" Let a king be left alone without any thing to ſa-

" tisfy his ſenſes, without any care in his mind, and
" retired from company, to think at leiſure on himſelf, and you will find that king left entirely to
" himſelf will appear a creature full of miſeries, and
" feel them like others."

61. Still the ſame ſophiſtical way of reaſoning. A king, who retires to indulge thoughts, is then fully occupied; but if he ſhould confine his thoughts wholly to himſelf, by ſaying, I reign, I am a king, and nothing more, he would be an idiot.

LXII.

" Every religion which does not acknowledge
" Chriſt Jeſus is notoriouſly falſe, and miracles can
" avail it nothing."

62. What is a miracle? Let us form what idea we pleaſe of it, it is a thing which the Almighty alone has the power of performing. Now here we have a ſuppoſition that God can work miracles in ſupport of a falſe religion: this is deſerving of a more ſerious conſideration: each of theſe queſtions would furniſh matter for a volume.

LXIII.

" We are told to believe in the church, but we are
" not told to believe in miracles, becauſe the latter is
" natural, and the former is not: we ſtood in need
" of a precept for the one, and not for the other."

63. Here I think is a contradiction. Firſt we are told that miracles would avail nothing on certain occaſions, and then, that we ought neceſſarily to believe in miracles, which is ſaying, that they were ſuch convincing proofs that there was no reaſon for recommending ſuch proofs. This aſſuredly is anſwering pro and con, and in a very dangerous manner.

LXIV.

" I do not ſee that there is a greater difficulty in
" believing in the reſurrection of the body and the
" conception of the bleſſed virgin, than the ſtory of
" the creation. For it is more difficult to reproduce a
" man than to produce him at firſt?"

64. Simple reaſoning will afford us proofs of the truth of the creation; for when we perceive that matter cannot exiſt, move, &c. of itſelf, we readily come to know that it muſt have been aſſiſted; but we can never diſcover by the bare help of reaſon how a body, which we ſee continually ſubject to change, is to be reſtored again to the ſame ſtate as it was in at the time it put on that change: neither will reaſoning ſatisfy us how a man could be produced without the ſeed peculiar to his ſpecies. Hence it follows, that the creation is an object of reaſon, but the other two miracles an object of faith only.

May 10, 1741.

I HAVE lately read ſome thoughts of Mr. Paſcal, which had not before appeared in public. They were copied by father Mollets from the hand-writing of that illuſtrious author, and have been lately printed. They ſeem to confirm what I have formerly ſaid, that this great genius had ſcattered his ideas looſely upon paper, with an intention of correcting ſome, making uſe of others, &c.

Among theſe latter thoughts, which the editors of Mr. Paſcal's works had denied a place in the collection, there are ſeveral which were worthy of being preſerved. The following are ſome of thoſe, which, in my opinion, this great man ſhould have corrected.

I.

"Though a propoſition may appear incomprehenſible, yet we muſt not abſolutely deny it on that account, but well examine its oppoſite; and if we find this manifeſtly falſe, then we may affirm the firſt, however inconceivable it may appear."

1. To me it appears evident, that two oppoſites may be equally falſe. An ox flies towards the ſouth with wings. An ox flies towards the north without wings. Twenty thouſand angels killed yeſterday the ſame number of men. Twenty thouſand men killed yeſterday twenty thouſand angels. Now theſe propoſitions are both of them evidently falſe.

II. "How

II.

" How vain an art is that of painting, which at-
" tracts our admiration by the reſemblance of things,
" whoſe originals we do not admire."

2. Certainly the merit of a portrait does not conſiſt in the goodneſs of heart of the perſon it reſembles, but in the likeneſs it bears to him. We admire Cæſar in one ſenſe, and his ſtatue, or his image on canvas, in another.

III.

" If phyſicians had not wore caſſocks and rode
" upon mules, and doctors of divinity appeared in
" ſquare caps and flowing robes, they never would
" have acquired that conſideration in the world which
" they now poſſeſs."

3. And yet phyſicians never ceaſed to be the objects of ridicule, never acquired real conſideration, till they had caſt aſide thoſe liveries of pedantry: and the head of an univerſity muſt leave behind him his ſquare cap and his arguments, if he would be received among the genteel world. There are even ſome countries where the magiſtrates make themſelves reſpected without pomp or parade. There are ſome kings in Chriſtendom, who neglect the ceremonies of conſecration and coronation. In proportion as mankind encreaſed in knowledge, they ſet leſs value upon particular garbs. Dreſs is now only uſed to captivate the vulgar, for whom it is ſtill ſometimes neceſſary *ad populum phaleras*.

IV.

" According to the lights of nature, if there is a
" God, he is infinitely incomprehenſible; becauſe as
" he is without parts or limits, he can have no rela-
" tion to us; therefore we are incapable of knowing
" either what he is, or if he exiſts."

4. It is very ſtrange, that Paſcal ſhould have thought we could gueſs at original ſin from reaſon, and that he ſhould ſay we cannot know from reaſon that God exiſts. It was probably the reading this thought

that made father Hardouin place Paſcal in his ridiculous liſt of atheiſts. Paſcal had moſt evidently renounced this notion, ſince he has combated it in ſeveral other places. In fact we are under a neceſſity of admitting ſeveral things, which we cannot conceive; "I exiſt, therefore ſomething exiſts from all eternity." This is an evident propoſition; and yet can we ſay, that we conceive what eternity is?

V.

"Do you think it impoſſible that God ſhould be in-
"infinite and without parts? I do. Well then, I will
"ſhew you what an infinite and indiviſible thing is.
"It is a point which moves itſelf on every ſide with
"infinite quickneſs, for it is in all places, and entire
"in every place."

5. Here are four palpable falſities. 1. That a mathematical point can exiſt by itſelf. 2. That it can move from right to left at the ſame time. 3. That it can move with infinite quickneſs; whereas there is no quickneſs, however great, but what may be augmented. 4. That it can be whole and entire in all places at once.

VI.

"Homer wrote a romance, and has given it to us
"as ſuch. No one ever believed the exiſtence of
"Troy or Agamemnon, any more than that of the
"golden apple."

6. No writer has ever ſo much as hinted a doubt of the reality of the Trojan war. The fabulous part of the ſtory of the golden apple does not deſtroy the foundation of the ſubject, any more than the fiction of the Ampulla brought by a dove, and the Oriflamme by an angel, impeach the truth of Clovis having reigned in France.

VII.

"I ſhall not pretend in this place to prove either
"the exiſtence of God, the trinity, or the immorta-
"lity of the ſoul, from natural reaſons; becauſe I
"ſhould

" ſhould want abilities to find arguments in nature
" ſufficient to convince an atheiſt."

7. Is it poſſible Mr. Paſcal ſhould want abilities to prove the exiſtence of God?

VIII.

" Mankind are, in general, ſo fond of free opini-
" ons, that it is ſurprizing ſuch ſhould ever diſpleaſe
" them."

8. But does not every day's experience ſhew us, that there is not ſo effectual a method of gaining a power over the minds of the vulgar, as by propoſing them the moſt difficult, nay, even the moſt impoſſible things, to perform or believe? What gained the Stoics ſo much credit, but only that they reduced human nature to the loweſt ebb? Propoſe only what is reaſonable, and every one will cry out, we knew this before. It requires no inſpiration to become popular. Only enjoin the performance of auſterities or impractacabilities; paint the deity as perpetually armed with thunders, and delighting in rivers of blood, the multitude will greedily hearken after you, and every one will ſay, this man muſt certainly have reaſon on his ſide, otherwiſe he would never publiſh ſuch extraordinary things with ſo much boldneſs.

I ſhall not ſend you the reſt of my remarks on Mr. Paſcal's thoughts, as this would lead me into too tedious inquiries. But as ſome have endeavoured to ſet up as laws thoſe thoughts which Mr. Paſcal probably ſcattered upon paper only as doubts, I thought it neceſſary to ſhew, that we ought not to look upon thoſe things as demonſtrations, that he himſelf would probably have refuted.

A DIA-

A DIALOGUE BETWEEN ARISTUS AND ACROTAL.

ACROTAL.

O Happy times, when the ſcholars of the Univerſity, who had all beards on their chins, knocked on the head that vile mathematician Ramus, and dragged his body, naked and ſmeared with blood, to the doors of all the colleges, there to do penance!

ARISTUS.

This Ramus, I ſuppoſe, was an abominable wretch; ſurely he muſt have committed the moſt enormous crimes.

ACROTAL.

Nothing leſs. He wrote againſt Ariſtotle, and was ſuſpected of ſomething ſtill worſe. It is a thouſand pities they had not knocked out the brains of that fellow Charon, who took it into his head to write a treatiſe on wiſdom: and Montagne too with his impudent reaſoning and pleaſantry. Oh! thoſe curſed reaſoners are the peſts of a ſtate.

ARISTUS.

Bad reaſoners indeed may be inſufferable; but I cannot ſee any occaſion to hang a poor man for a few falſe ſyllogiſms: beſides, in my opinion, the men, you are exclaiming againſt, reaſon tolerably well.

ACROTAL.

So much the worſe; that makes them the more dangerous.

ARISTUS.

In what reſpect, pray? Did you ever know philoſophers occaſion famine, war, or peſtilence, in a country? Did Bayle, for example, againſt whom you ſo bitterly inveigh, did he ever attempt to break down the dykes in Holland, to drown the inhabitants, as a certain great ſtateſman, who is no philoſopher, is ſaid to have propoſed?

ACROTAL.

Would to God that Bayle had been drowned and all the reſt of the Dutch heretics! Why was there ever ſuch an abominable fellow in the world? He ſets things forth with ſuch an odious fidelity, and places the arguments on both ſides before our eyes with ſo mean an impartiality, and is ſo inſupportably intelligible, that he puts even thoſe of the moſt common underſtanding in a condition to judge, and even to doubt, of what is told them. There is no bearing this; and for my part I confeſs, that whenever I hear the name of this man, and ſome others like him, mentioned, it throws me into a fit of holy rage.

ARISTUS.

I do not believe that either he or his followers ever intended to put you in a rage — but whither are you running in ſuch a hurry?

ACROTAL.

To pay my reſpects to Monſieur *Bardo bardi*. I have waited theſe two days for an audience from him; but he has been always engaged either with his page or his miſtreſs, ſo that I have not been able to get at the ſpeech of him.

ARISTUS.

He is now at the opera. But pray what urgent buſineſs may you have with him?

ACROTAL.

Why I want to engage him to uſe his intereſt to have a little raſcally abbé burnt, who has lately introduced amongſt us the opinions of one Locke, an Engliſh philoſopher. Only think of that! What abominable impiety!

ARISTUS.

Well, but pray what are theſe very abominable opinions of this Engliſhman?

ACROTAL.

What do I know? Why, for example, he ſays, that we do not give ourſelves our ideas; that God is the maſter of all things, and can beſtow ſenſations and ideas on any being he ſhall be pleaſed to chuſe; that we are not acquainted either with the eſſence or elements of matter; that men do not always think; that a drunken man, when aſleep, has not his ideas ſo clear as when awake and ſober; with a thouſand other impertinences of equal weight.

ARISTUS.

Very well, and ſuppoſing this ſame raſcally abbé the pupil of Locke is ſo wrong-headed, as not to believe that a drunken man in his ſleep meditates a great deal, muſt you for that reaſon perſecute him? What ill has he done? Has he conſpired againſt the ſtate? Has he mounted the pulpit to hold forth in the praiſe of theft, calumny, or murder? And pray tell me, between you and I, do you know one ſingle inſtance of a philoſopher's having cauſed the leaſt diſorder in ſociety?

ACROTAL.

Never, I muſt acknowledge.

ARISTUS.

Are they not, for the moſt part, perſons of retired lives? Are they not generally poor, without protection or ſupport? and is it not partly on this very account that you proſecute them, as thinking them the more eaſy to be oppreſſed?

ACROTAL.

Formerly indeed thoſe of this ſect were perſons of very little credit or conſideration in the community, mere private citizens, ſuch as Socrates, Pomponatius, Eraſmus, a Bayle, or a Deſcartes; but now philoſophy has aſcended to the very ſeats of judicature, and even aſcended the throne; every one prides himſelf in making uſe of his reaſon, except in ſome countries indeed where we had taken care to put matters upon a different footing. Now this is of a moſt fatal tendency, and calls upon us to uſe our utmoſt endeavours to extirpate thoſe philoſophers at leaſt, who have neither fortunes, poſſeſſions, rank, nor power, in this world, as we cannot wreak our revenge upon thoſe that have.

ARISTUS.

Your revenge! and for what pray? Have theſe poor people ever diſputed with you your poſts, your priveleges, or your wealth?

ACROTAL.

No, they hold us in contempt, if I muſt ſpeak the truth, and ſometimes make us the ſubjects of their raillery. Now that you know we never forgive.

ARISTUS.

If they make a jeſt of you they do wrong; we ſhould make a jeſt of no one: but tell me, I beſeech you, how it comes about, that they have never made a jeſt of the laws or the magiſtrates of any country, and at the ſame time ridicule your body ſo unmercifully as you ſay they do.

ACROTAL.

Why that is the very thing that raiſes our choler, for we are far ſuperior to the laws.

ARISTUS.

And this is preciſely the reaſon why ſo many worthy men have turned you into ridicule. You would have the laws, that are founded on univerſal reaſon, and by the Greeks called the daughters of heaven, give away to certain opinions, which are alike begotten and deſtroyed by caprice. Can you do otherwiſe than know, that what is juſt, clear and evident, is eternally held in veneration by the world while chimeras and idle dreams ſcarce challenge its attention?

ACROTAL.

Let us have done with the laws and the judges, and ſtick to the philoſophers: it cannot be denied, that they formerly ſaid and did as many ridiculous things as ourſelves; therefore we are bound to ſtand up againſt them, if it is only through jealouſy, like two of a trade.

ARISTUS.

Numbers of them have undoubtedly broached fooliſh opinions, becauſe they were men; but their fancies, however idle, never kindled civil war, whereas yours have been the cauſe of ſeveral.

ACROTAL.

And in this are we truly admirable. Can there be any thing more glorious, than to have put the whole world into commotion by a few arguments? Do we not in this reſemble thoſe magicians and enchanters of old, who could raiſe ſtorms and tempeſts by a few words? Were it not for theſe raſcally fellows with their underſtandings, we ſhould be lords of the univerſe.

ARISTUS.

Well then, tell them they have no underſtanding; prove to them that they reaſon badly: they have rally'd you, why do you not ridicule them in their turn? But, my dear Doctor, I muſt intercede with you for that poor diſciple of Locke, that you are in ſuch haſte to have burnt. Conſider thoſe ſort of proceedings are now quite out of faſhion.

ACROTAL.

I believe you are in the right; we muſt fall upon ſome other method of ſilencing theſe inſignificant philoſophers.

ARISTUS.

Take my advice, be ſilent yourſelf. Do you and your fraternity lay under the rage of diſputation: be compaſſionate and benevolent: ſeek not for evil where it is not, and it will ceaſe to be where it is.

HISTORY

OF A GOOD

BRAMIN.

IN my travels I happened to meet with an old Bramin. This man had a great ſhare of prudence and underſtanding, and was very learned. He was alſo rich, and his riches added to his wiſdom; for, wanting nothing, he had no temptation to defraud any one. His family was admirably well managed by three handſome wives, who ſtudied to pleaſe him; and when he was weary of amuſing himſelf with women, he had recourſe to philoſophy.

Not far from his houſe, which was handſome, well-furniſhed, and embelliſhed with the moſt delightful gardens, dwelt an old Indian woman, who was a great bigot, ignorant, and withal very poor.

I wiſh, ſaid the Bramin to me one day, I had never been born! Why ſo? ſaid I. Becauſe, replied he, I have been ſtudying theſe forty years, and I find it has been ſo much time loſt. While I teach others I know nothing myſelf. The ſenſe of my condition is ſo humiliating, it makes all things ſo diſtaſteful to me, that life is become a burthen. I have been born, and I exiſt in time, without knowing what time is: I am placed in the confines between two eternities, as our wiſe men ſay, and yet I have no idea of eternity: I am compoſed of matter, I think, but have never been able to ſatisfy myſelf, what it is that produces thought: I even am ignorant, whether my underſtanding is a ſimple faculty I poſſeſs, like that of walking and digeſting; or if I think with my head in the ſame manner as I take hold of a thing with my hands. I am not only thus in the dark with relation to the principles of thought, but the principles of my motions are entirely unknown to me: I do not know why I exiſt, and yet I am applied to every day for a ſolution of theſe matters, and I muſt return an anſwer: I can ſay nothing ſatisfactory on the head: I talk a great deal, and, when I have done ſpeaking, remain confounded and aſhamed of what I have ſaid.

I am in ſtill greater perplexity when I am aſked, if *Brama* was produced by *Witſnou*, or if they have both exiſted from eternity. God is my judge, that I know nothing of the matter, as plainly appears by my anſwers. Reverend father, ſays one, be pleaſed to inform me, how evil is ſpread over the face of the earth. I am as much at a loſs as thoſe who aſk the queſtion. Sometimes I tell them, that every thing is for the beſt; but thoſe who have the gout or the ſtone, thoſe who have loſt their fortunes and their limbs in the wars, believe nothing of it any more than myſelf. I retire to my own houſe full of curioſity and ignorance. I conſult the writings of our antient ſages, and they ſerve only to bewilder me the more. I talk with my brethren upon the ſubject: ſome tell me we ought to make the moſt of life, and laugh at the world; others think they know ſomething, and loſe themſelves in vain and chimerical hypotheſes: every thing adds to the load I feel. Sometimes I am ready to fall into deſpair, when I reflect, that, after all my reſearches, I neither know from whence I came, what I am, whither I ſhall go, or what is to become of me.

The condition in which I ſaw this good man gave me real concern. No one could be more rational, no one more open and honeſt. It appeared to me, that the force of his underſtanding, and the ſenſibility of his heart, were the cauſes of his miſery.

The ſame day I had a converſation with the old woman, his neighbour. I aſked her if ſhe had ever been afflicted at not knowing how her ſoul was made? She did not ſo much as underſtand my queſtion: ſhe had not, even for a moment in her life, a thought about theſe two ſubjects, concerning which the Bramin had ſo tormented himſelf: ſhe believed, from the bottom of her heart, in the metamorphoſes of her god *Witſnou*, and provided ſhe could get ſome of the waters of the Ganges to make her ablutions, ſhe thought herſelf the happieſt of women.

Struck with the happineſs of this poor creature, I returned to my philoſopher, whom I thus addreſſed: are you not aſhamed to be thus miſerable, when not fifty yards from you, there is an old automaton, who thinks of nothing and lives contented? You are right, replied he; I have ſaid to myſelf a thouſand times, that I ſhould be happy, if I was but as ignorant as my old neighbour; and yet it is a happineſs I would not wiſh for.

This reply of the Bramin made a greater impreſſion on me than any thing that had paſſed. I examined my own heart, and found, of a truth, that I myſelf ſhould not wiſh to be happy, on condition of being ignorant.

I propoſed this matter to ſome philoſophers, and they were all of my opinion: and yet, ſaid I, there is ſomething very contradictory in this manner of thinking; for after all, what is the queſtion? Is it not to be happy? What ſignifies it then, whether we have underſtandings or whether we are fools? Beſides there is this to be ſaid: thoſe, who are contented with their condition, are ſure of that content; whereas thoſe, who have the faculty of reaſoning, are not always ſure of reaſoning right. It is evident then, added I, that we ought rather to wiſh not to have common ſenſe, if that common ſenſe contributes to our being either miſerable or wicked. They were all of my opinion, and yet not one of them could be found to accept of happineſs on the terms of being ignorant. From hence I concluded, that though we may ſet a great value upon happineſs, we ſet a ſtill greater upon reaſon.

But, after having maturely reflected upon this affair, I thought there was great madneſs in preferring reaſon to happineſs. How is this contradiction to be explained? Like all others. A great deal may be ſaid about it.

ON ALLEGORIES.

ONE day Jupiter, Neptune and Mercury, being upon their travels in Trace, took up their lodgings with a king named Hyrieus, who gave them a cordial reception. The three deities, after having made a plentiful meal, aſked their hoſt, what they ſhould do for him in return for his civility. The good man, who was paſt having children, told them, he ſhould be very much obliged to them if they would give him a ſon. The gods immediately ordered the hide of a bullock newly killed to be brought them, and piſſing therein all three, Orion was born from the mixture, who was afterwards made a conſtellation, and known in the earlieſt times of antiquity. This conſtellation had the name of Orion given it by the ancient Chaldeans, and we find it mentioned in the book of Job. But after all it is not eaſy to conceive how the urine of three gods could produce a boy. It will be a difficult matter for the Daciers or Saumars to find a reaſonable allegory in this curious tale, unleſs they have a mind to infer from hence, that nothing is impoſſible to the gods, ſeeing they can get children by piſſing.

There were two rakehelly young blades in Greece, who were told by an oracle to beware of Melampegos: one day Hercules happened to meet with them, and tying them together by the feet to the end of his club, flung them in that manner acroſs his back with their heads downwards like a brace of rabbits. Melampegos in Greek ſignifies black arſe. Upon ſeeing Hercules's breech they immediately cried out to one another, the oracle is fulfilled, this is *black arſe.* Hercules fell a laughing, and let them go about their buſineſs. Now, I ſay once again, were the Daciers and the Saumars to ſtudy till they cracked their brains, they would never be able to draw a moral ſenſe from theſe fables.

Among the fathers of mythology, there were ſome few who had the gift of a fruitful imagination; but far the greateſt part of them joined to this imagination a great deal of wit. Not all our accademies or makers of devices, even thoſe who compoſe the legends for the counters of the royal treaſury, will be able to hit upon more juſt, more pleaſing, or more ingenious allegories, than thoſe of the nine Muſes, of Venus, the Graces, the God of Love, and ſeveral others, that will continue to be the delight and inſtruction of all ages, as I have already obſerved in another place.

It muſt be acknowledged, that the ancients almoſt always explained themſelves by allegories. The primitive fathers of the church, who were for the moſt part Platoniſts, copied this method from their maſter Plato. They have been cenſured indeed for having carried this paſſion for allegories and alluſions too far.

St. Juſtin, in his apology ſays, that the ſign of the croſs is impreſſed upon the members of the human body; that when a man ſtretches out his arms, he is the perfect figure of a croſs, and that the noſe forms an exact croſs with the face.

According to Origen, in his explanation of Leviticus, the fat of the victims ſignifies the church, and the tail is a ſymbol of perſeverance.

St. Auguſtin, in his ſermon on the difference and agreement of the two genealogies, thus explains to his auditors why St. Matthew, though he reckons forty-two generations, gives us an account of forty-one only. The reaſon is, ſays he, we ought to reckon Jeconias twice, becauſe he went from Jeruſalem to Babylon. Now this journey is the cornerſtone, and as the cornerſtone is one foot in the ſide of one wall, ſo it is likewiſe on the ſide of the other wall. This ſtone therefore may be counted twice, and in like manner we may reckon Joconias twice. He adds, moreover, that we ſhould ſtop at the number forty in the forty-two generations, becauſe that number ſignifies life. Ten is the figure of beatitude and ten multiplied by four, which repreſents the four elements and the four ſeaſons, produces forty.

In his fifty-three ſermons he has aſcribed moſt amazing emblematical properties to the dimenſions of matter. Breadth is the dilatation of the heart. Length long ſuffering and patience. Height is hope and depth of faith. So that, excluſive of the allegory, matter is here made to have four dimenſions inſtead of three.

It is clear and indubitable, ſays he in his ſermon on the 6th pſalm, that the number forty is an emblem of man's body, on account of the four elements, and the four qualities, heat, cold, dryneſs and moiſture; and as the number four relates to the body, the number three belongs to the ſoul; becauſe we are to love God with a threefold love with all our heart, with all our ſoul, and with all our mind. The number *four* has affinity to the Old Teſtament, and that of *three* to the New. Four and three make the number of ſeven days complete, and the eighth is the day of judgment.

There is no denying, that moſt of theſe allegories have an air of miſplaced affectation, little ſuitable to real eloquence: but then it ſhould be conſidered, when we find thoſe Fathers ſometimes make uſe of theſe figures, that they wrote in an age and in a country, where almoſt all the arts were degenerated, and ſuffered their ſublime genius and deep erudition to ſtoop to the weakneſs and imperfections of the times; and St. Auguſtin is no leſs worthy of our veneration, for having paid this tribute to the bad taſte of Africa in the 4th century.

The diſcourſes of our modern preachers are free from theſe blemiſhes; not that we preſume to prefer them to the fathers, only the preſent age is preferable to thoſe in which they wrote. Eloquence after them became every day more and more corrupted, nor did it recover itſelf till of late years. It ran into many exceſſes ſtill greater than thoſe we have mentioned; and among the barbarous nations it was even ridiculous till the age of Lewis XIV. If we look into the old ſermons, we ſhall find moſt of them even far below the dramatic pieces of paſſion, which were played at the *Hôtel de Bourgogne*. But in theſe barbarous ſermons we may ſtill find a taſte for allegory, which has never been wholly laid aſide. The famous Menot, who lived in the reign of Francis I. was the writer who did moſt honour to the allegorical ſtyle. The gentlemen of our courts of juſtice, ſays he, are like a cat, to whoſe care a cheeſe is committed, leſt the mice ſhould gnaw it; a ſingle bite of the cat would do the cheeſe more damage than the nibbling of twenty mice.

The following paſſage is no leſs curious: "The "woodcutter in a foreſt lops off both great and "ſmall branches, and makes them up into ſaggots "together. In the ſame manner do our church-"men, by virtue of diſpenſations from Rome, ac-"cumulate to themſelves both great and ſmall "benefices. The Cardinal's hat is garniſhed with "biſhoprics; the biſhop's with abbeys and pri-"ories; and all together are garniſhed with devils. "All the wealth of the church muſt paſs through the "hands of three Cordeliers of the Ave Maria. The "*Benedicta tu* are fat abbeys of Benedictines; in "*mulieribus*, is the patron and his lady; and *fruc-"tus ventris*, feaſting and merry making."

The ſermons of *Barbet* and *Maillard* are exactly in the ſame ſtyle; they were delivered partly in bad Latin and partly in bad French. The ſermons in Italy were in the ſame taſte. In Germany it was ſtill worſe. This monſtrous medley gave birth to the Macaronic ſtyle, which is the maſter-piece of barbariſm. This kind of eloquence, fit only for Huns and Hottentots, kept its ground till the time of Lewis XIII. The Jeſuit Goraſſa, one who ſignalized himſelf amongſt the opponents of common ſenſe, never preached in any other. He compared the celebrated Theophilus to a Calf, becauſe Theophilus' former name happened to be *Viaud*. Now the Fleſh of a calf, ſays he, is good to roaſt or boil, but thine is fit only to be burnt.

What a difference between the allegories made uſe of by our barbarous writers, and thoſe we meet with in Homer, Virgil, and Ovid! And therefore if we have amongſt us any remains of thoſe Goths and Vandals, who affect a contempt for the fables of antiquity, it is plain they have not much reaſon on their ſide.

ON POLYTHEISM.

THE belief of a plurality of gods is one of the great errors with which the moderns reproach the Greeks and Romans: but let any one ſhew me, in one word, from whence it may reaſonably be infered, that they had more than one ſupreme God, and I will allow the cenſure to be juſt: but if no ſuch feat, no ſuch expreſſion, can be found; but, on the contrary, they every where abound with monuments and paſſages, which bear teſtimony to one ſupreme God, ſuperior to all the other gods; we are bound to acknowledge, that the judgements paſſed on the ancients are as raſh, as thoſe we frequently paſs upon our cotemporaries.

We may read in a thouſand different places in their writings, that Zeus, Jupiter, is the maſter of gods and men. *Jovis omnia plena.* And St. Paul himſelf gives the following teſtimony with regard to the antients. "In God we live and move, and have our "being, as one of your poets expreſſes it." After this teſtimony ſhall we preſume to accuſe our maſters of not acknowledging a ſupreme God?

We are not here to examine, whether there was in former times a Jupiter, King of Crete; whether he was made a God; or whether the Egyptians had twelve great Gods, or eight; or whether the Jupiter of the Latins was one of this number? The preſent object of inquiry is to know, whether the Greeks and Romans acknowledged a divine being, ſupreme over the reſt of the heavenly beings. This they are for ever repeating, and therefore we cannot but believe them.

Let us only look into the admirable epiſtle of the philoſopher Maximus of Medavra to St. Auguſtin: "There is one God," ſays he, "without beginning, the common parent of all things, who has never begotten any one like himſelf. Who is the man ſo brutiſh or ſtupid as to entertain a doubt thereof?"

Thus does this heathen, who wrote in the fourth century, declare the ſentiments of all antiquity.

If I was to draw the veil of the Egyptian myſteries, I ſhould there find the *Knit* by whom all things were produced, and who preſides over all the other deities; I ſhould find *Mithra* among the perſians, *Brama* among the Indians; and it is more than probable, that I ſhould be able to demonſtrate, that every well-governed nation acknowledged a ſupreme being, who had other inferior gods ſubordinate to him. I ſhall not inſtance the Chineſe, whoſe government, the moſt reſpectable on the earth, hath never acknowledged any more than one ſole God for upwards of 4000 years. But to confine myſelf to the Greeks and Romans, who are the principal ſubjects of this inquiry. It is alledged, they admitted numberleſs ſuperſtitions. There is no doubt of it. Every one knows they adopted the moſt ridiculous fables, and to this I add, that they themſelves laughed at them. The baſis of their mythology, however, was founded in reaſon.

In the firſt place, allowing that the Greeks gave their heroes a place in heaven, as a reward for their virtues. This was a moſt prudent and uſeful act of religion. What more glorious recompence could they have given them? What nobler incentive could have been propoſed? Are we to cenſure this? We, who, bleſſed with the light of truth, have religiouſly preſerved this cuſtom which the ancients firſt thought of? The number of ſaints, to whom we have raiſed temples and altars, infinitely exceed thoſe of the Greek and Roman demi-gods and heroes: the only difference is, that they granted the honour of an apotheoſis to the moſt illuſtrious and conſpicuous actions; we to the more mild and modeſt virtues. But their deified heroes, though they were admitted into the court, or partook of the favours of Zeus, the *Demiurgos*, the eternal Lord, they did not ſhare his throne or power: and what is there ſo very irrational in all this? Is it not a faint type of our heavenly hierarchy?

Nothing can convey a more ſalutary moral; and beſides it is not phyſically impoſſible in itſelf. Here is no reaſon to turn into ridicule a nation, to whom we are indebted for the knowledge of our alphabet.

The ſecond ſubject of reproach we have againſt them is, for admitting ſuch a number of Gods into the government of the world. Neptune preſides over the ſea; Juno over the air; Æolus over the winds; Pluto or Veſta over the earth, and Mars over the field of battle. Let us reject theſe genealogies, which were as falſe as many of thoſe modern ones that are every day beſtowed upon men; let us condemn all their adventures, which are fit only for the Arabian Nights Entertainments, and which never made any part of the baſis of the Greek or Roman religion: but, in the name of goodneſs, where would be the ſtupidity of adopting beings of the ſecond order, to whom ſome degree of power is given over us; mortals who are, perhaps, only of the hundred thouſandth. Is there any bad philoſophy in this, any phyſical falſity? Do we not acknowledge nine orders of celeſtial ſpirits ſuperior to men? Have not theſe nine orders each a different name, and did not the Jews borrow moſt of theſe names from the Perſians? Do we not aſſign particular functions to ſeveral Angels? There was a deſtroying angel who fought for the Jews. There was the angel of travellers, who ſerved as a guide to Tobias. Michael was the tutelary angel of the Hebrew people. We are told in Daniel, that he ſought with the angel of the Perſians, and diſputed with the angel of the Greeks. In the prophet Zachary we read of an angel of an inferior order, who gives an account to Michael of the ſtate in which he found things upon earth. Every nation has its particular angel. The ſeptuagint verſion tells us in Deuteronomy, that the Lord divided the nations according to the number of the angels. St. Paul in the acts addreſſes himſelf to the angel of Macedonia. Theſe celeſtial ſpirits are often called by the name of Gods, *Eloim*, in ſcripture; and the word that anſwers to *Theos*, *Deus*, God, in all nations, does not conſtantly ſignify the ſupreme maſter of heaven and earth, but frequently a heavenly being; a being ſuperior to man, though dependent upon the ſovereign Lord of nature. The title is even given at times to princes and rulers.

Since then it is held as a real truth with us, that there are heavenly ſubſtances charged with the care of men and empires, thoſe nations, who have admitted this truth, without the light of revelation, are certainly more worthy of our eſteem than contempt.

The ridicule or error then does not lie in polytheiſm itſelf, but in the abuſe made of that belief in the vulgar fables, and in the multitude of ridiculous deities, which every one ſet up after his own fancy.

The goddeſs of the breaſts *Dea Rumilia*, the goddeſs of the conjugal art *Dea Pectunda*, the god of cloſeſtools *Deus Stercutius*, and the god of f—t—g *Deus Crepitus*, are certainly no very reſpectable deities. Theſe puerilities, which ſerved as the amuſements of the old women and children of Rome, only prove that the word *Deus* had very different acceptations. It is certain, that the *Deus Crepitus* did not cauſe the ſame idea as *Deus divum et hominum pater*, the father of Gods and Men. The Roman pontifs never gave a place in their temples to thoſe little puppets, with with which the good women uſed to fill their chambers and cloſets. The religion of the Romans was in the main extremely grave and rigid. Oaths were held inviolable. They could not begin a war till the College of the Feciales had declared it juſt. A veſtal, that was convicted of having broke her vow of virginity, was condemned to die. All which beſpeaks a people rather rigid than ridiculous in their morals.

I ſhall confine myſelf here to prove, that the Roman ſenate ſhewed no marks of weakneſs in adopting polytheiſm. It may be aſked me, how a ſenate, who by two or three of their deputies only impoſed chains and laws upon us, could ſuffer ſo many extravagancies, and countenance ſuch a heap of abſurd fables among their pontifs? I ſhall find no great difficulty in anſwering this queſtion. Wiſe men in all ages have made uſe of fools. They willingly left the people in poſſeſſion of their favourite feaſts the Lupercalia and Saturnalia, ſo long as they continued obedient to authority. The holy chickens, who foretold victory to their armies, were exempted from the ſpit and the pot. Never let us be ſurpriſed, that the wiſeſt governments have permitted the moſt ridiculous cuſtoms or improbable fables. Theſe cuſtoms, theſe fables, exiſted before thoſe governments were formed; and we do not pull down an extenſive and irregular city, merely for the ſake of building it again by rule and compaſs.

But how happens it, ſome one will ſay, that, on the one hand, we perceive ſo much philoſophy and ſcience, and on the other ſo much fanaticiſm? It is becauſe ſcience and philoſophy came to the world a little before Cicero, and fanaticiſm had already been in being for many ages. Policy then ſaid to folly and fanaticiſm, let us live all three together as comfortably as we can.

Philoſophical Miſcellanies.

EPISTLE,
ON THE
NEWTONIAN PHILOSOPHY,*
TO THE
Marchioneſs of CHASTELET.

IMMORTAL Emily, moſt powerful mind,
Pallas of France, and glory of thy kind;
Surpaſſing age, even in the bloom of youth,
The pupil, friend, of Newton and of truth.
Thy fires tranſpierce me, and thy charms controul;
I feel the force, the brightneſs of thy ſoul!
To thee attracted, I renounce the bays
Sought on the ſtage, while yet I liv'd on praiſe.
My wit, corrected, roves not as before,
Of vain appplauſe idolatrous no more!
Let earthborn Rufus with reſentment rave,
And drag his ſenſeleſs fury to the grave.
In rhyme ſtill ſtraining coldly to encloſe
Some trivial thoughts, that would depreciate proſe,
That harmleſs thunder let him hurl at me,
Which firſt his rage for others might decree.
To blaſt my fame let pedant Zoilus ſeek,
And ſpread unmeaning malice once a week;
With me their envy withers in the bud;
I ſee no tracks imprinted in the mud.
Philoſophy, all charming powerful queen,
Lifts the wiſe mind above corroding ſpleen.
Happy on high, where Newton now remains,
Knows he on earth if enmity yet reigns?
Not more than he my enemies I know,
While truth auguſt invites me from below.
Already ſee ſhe opes the gate of day!
The liſts I enter, and purſue my way!

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* This Epiſtle was prefixed to the Elements of Newton's Philoſophy, publiſhed by M. de Voltiare, in 1738 and 1741.

The maſſy whirlpools heaving ſtill for place,
Heap'd without rule, and moving without ſpace,
Thoſe learned phantoms vaniſh from my ſight,
And day comes on me with her genuine light!
That vaſt expanſe, of being the abode,
Space that contains th' immenſity of God;
Sees in her breaſt this bounded ſyſtem move,
Of planets, worlds beneath us and above:
Whoſe whole extent, ſo wond'rous to our ſenſe,
Is but a point, an atom in th' immenſe.
  God ſpeaks, and chaos at his voice ſubſides,
In various orbs the mighty maſs divides;
At once they gravitate, they ſtrive to fall,
One centre ſeeking which attracts them all.
That ſoul of nature, that all moving ſpring,
Lay long conceal'd, an unregarded thing;
Till Newton's compaſs, moving through the ſpace,
Meaſures all nature, and diſcovers place.
The famous laws of motion are ſurvey'd,
Drawn back the veil, the heav'ns are all diſplay'd.
  His learned hand unfolds the glitt'ring robe,
That clothes yon lucid animated globe,
Who guides the ſeaſons and who rules the day,
Mine eyes diſtinguiſh each emitted ray.
With purple, azure, emerald and roſe,
Th' immortal tiſſue of his habit glows.
Each emanation in pure ſubſtance bears
The various colours that all nature wears:
Thoſe blended tints illuminate our eyes,
Give life to matter, fill th' expanded ſkies.
Eternal pow'rs, who, near the king of kings,
Burn with his fires, and cover with your wings
His throne; O ſay! when viewing Newton's plan,
Were you not jealous of that wond'rous man?
  The ſea too hears him! with ſtupendous dance
I ſee the humid element advance!
Tow'rds heav'n it riſes; heav'n attracts it high;
But central power, more potent, as more nigh;
Each effort ſtops: the ſea recoils; it roars;
Sinks in its bed, and rolls againſt the ſhores.
  Ye comets, dreaded like the bolts of Jove,
In vaſt ellipſes regularly move!

Ceaſe with your motions mortals to affright:
Remount, deſcend near the great orb of light:
Elance your fires; fly, and, as each appears,
Reſtore the vigour of exauſted ſpheres.
Thou, ſiſter of the ſun, who in the ſkies,
Of dazzled ſages mock'd the feeble eyes;
Newton has mark'd the limits of thy race,
March on, illumine night, we know thy place.
Earth, change thy form; let the great law of matter,
Depreſs thy poles and heighten th' Equator.
Avoid, thou pole, that fix'd to ſight appears,
The frozen chariot of the northern bears:
Embrace in each of thy immenſe careers,
Almoſt three hundred centuries of years. †
  How beautiful theſe objects; how the mind
Flies to thoſe truths enlighten'd and refin'd!
Yes, in the breaſt of God, it may rejoice,
And, far from matter, hear the eternal's voice.
  Thou, whom that voice familiarly invites,
Say, ev'n in youth, the ſeaſon of delights,
How haſt thou dar'd, in ſpite of cuſtom's force,
To move ſo boldly thro' ſo vaſt a courſe?
To follow Newton in that boundleſs road,
Where nature's loſt, and ev'ry thing but God?
Purſuing thee I venture to advance,
And bring home truth, that wanderer, to France.
While Algarotti ‡ ſure to pleaſe and teach,
Conducts the ſtranger to the Latian beach.
With native flow'rs adorns the beauteous maid,
And Tyber wonders at ſuch worth diſplay'd;
I graſp the compaſs, and the out-lines trace,
And with coarſe crayons imitate her face.
Th' immortal fair all ſimple, noble, grand,
Should I attempt it, my unſkilful hand,
To her, as thee, no luſtre could impart,
Above all praiſe, and far above my art.

A NEW

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† The period of the proceſſion of the equinoxes, which is finiſhed in twenty ſix thouſand nine hundred and twenty years.

‡ M. Algarotti, a young Venetian, was then printing at Venice a treatiſe of light, in which he explains attraction. M. de Voltaire was the firſt in France that explained the diſcoveries of the great Newton.

A NEW DEDICATION TO THE Marchioneſs of CHASTELET,

Of the Edition of 1745.

Madam,

THE firſt time I placed your reſpectable name at the head of theſe elements of philoſophy, we ſtudied together; but you have ſince taken a flight I am no longer able to follow. My caſe, therefore, is now like that of a grammarian, dedicating a treatiſe of rhetoric to a Demoſthenes or a Cicero. I am offering ſimple elements to a perſon, who has penetrated all the depths of the higher geometry, and who alone among us has tranſlated, and written comments on, the great Newton.

That philoſopher in his life-time reaped all the glory he deſerved. He excited no envy, as he could have no rival. The learned world were his diſciples; and others admired, without preſuming to underſtand him. But the honour done him by you, is certainly the greateſt he ever received. I am at a loſs which to admire moſt, Newton, the inventor of the Fluxionary calculations, who diſcovered new laws in nature, and anatomized light; or you, madam, who, amidſt the diſſipations annexed to your condition, are ſo well acquainted with all his diſcoveries. Thoſe who ſee you at court will hardly look upon you as a commentator on philoſophy; and the learned, who are learned enough to read your writings, will ſtill leſs conceive, that you can ſtoop to tranſitory amuſements, with the ſame eaſe you ſoar to the moſt ſublime truths. This eaſineſs and ſimplicity, ever highly valuable, but ſo rarely joined with talents and ſcience, will at leaſt procure pardon for your merit. This is, in general, all that can be hoped from perſons with whom we converſe; but the ſmall number of ſuperior geniuſes, who have applied themſelves to the ſame ſtudies, will conceive the higheſt veneration for you, and poſterity will look on you with aſtoniſhment. That perſons of your ſex have reigned gloriouſly over large empires does not ſurprize me. A woman, with a wiſe council, may rule like an Auguſtus: but to penetrate, with indefatigable labour, truths which intimidate moſt perſons to approach, to diſplay, in hours of leiſure, what the greateſt philoſophers are inceſſantly ſtudying; is a gift, Madam, peculiar to yourſelf, and exhibits a pattern that will be very rarely imitated, &c.

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ELEMENTS

OF

NEWTON'S PHILOSOPHY.

IN THREE PARTS.

PART I.

CHAP. I.

OF GOD.

Reaſons which every perſon does not approve. Reaſons of the Materialiſts.

NEWTON was fully perſuaded of the exiſtence of a God, and by that term underſtood not only an infinite, almighty, eternal, creative being; but a maſter, who had eſtabliſhed a relation between himſelf and his creatures; as, without this relation, the knowledge of God is only a barren idea, which would ſeem to invite every reaſoner of a perverſe nature, to the practice of vice, by the hopes of impunity.

Accordingly, that great philoſopher, at the end of his Principia, makes a ſingular remark, namely, that we do not ſay my eternal, my infinite, becauſe theſe attributes do not at all relate to our nature; but we ſay, and it is our duty to ſay, my *God*; and thereby to underſtand the maſter and preſerver of our life, the object of our thoughts. I remember, that in ſeveral converſations I had in 1726, with Dr. Clarke, that philoſopher never mentioned the name of God, but with a remarkable air of recollection and reſpect; and when I owned to him, how much it affected me, he ſaid he had inſenſibly from Newton acquired that cuſtom, which ſhould indeed be the cuſtom of every man. Newton's whole philoſophy neceſſarily leads to the knowledge of a ſupreme being, who has freely created, and arranged all things. For if the world be finite; if there be a vacuum, the exiſtence of matter is not neceſſary; and therefore has received exiſtence from a free cauſe. If matter gravitates, as we know it does from demonſtration, it does not appear to gravitate from its nature, as it is extended by its nature; it has therefore received its gravitation from God. If the planets in a ſpace void of reſiſtance, revolve one way rather than another, the hand of their creator muſt have directed their courſe that way, with an abſolute freedom.

The imaginary phyſical principles of Deſcartes are very far from leading the mind in this manner to the knowledge of its creator. God forbid that I ſhould be guilty of ſo horrid a ſlander, as to charge that great man with diſowning the ſupreme intelligence to which he was ſo highly indebted, and which had raiſed him above almoſt all the men of his age. I only ſay, that the abuſe he has ſometimes made of his genius, has led his followers to precipices, from which their maſter kept himſelf at a great diſtance. I ſay, the Carteſian ſyſtem has produced that of Spinoſa: I ſay, I have known many perſons led by Carteſianiſm to admit of no other God than the immenſity of things; while, on the contrary, I never knew one Newtonian, who was not a Theiſt, in the ſtricteſt ſenſe. He who, with Deſcartes, is once perſuaded, that it is impoſſible for the world to be finite; that motion is ever the ſame; when any one can preſume to ſay, give me motion and matter, and I will make you a world: then ſuch ideas, it muſt be owned by conſequences too juſt, ſeem to exclude the idea of a being alone infinite, alone author of motion, alone author of the organizations of ſubſtances.

It may perhaps appear ſtrange to many, that among all the proofs of the exiſtence of a God, the ſtrongeſt in Newton's opinion, is that of final cauſes. The deſign, or rather the deſigns, various *ad infinitum*, diſplayed in the moſt enormous and moſt minute parts of the univerſe, form a demonſtration, which, from its being ſo manifeſtly ſenſible, is little regarded by ſome philoſophers; but Newton thought, that theſe infinite relations, which he, more than any other man, diſcerned, could only be the work of an Artiſt infinitely wiſe.

He made little account of the proof drawn from the ſucceſſion of beings. It is commonly ſaid, that if men, animals, vegetables, and whatever compoſe this world, were eternal, a ſeries of generations, without cauſe, muſt of conſequence be admitted. The exiſtence of theſe beings, it is ſaid, would have no origin; no external can be ſuppoſed to riſe again from generation to generation, without a begining; no external, becauſe no one can exiſt of itſelf. Thus every thing would he effect, and nothing cauſe.

This argument appeared to him founded only on the ambiguity of *generations*, and of beings *formed one by the other*. For atheiſts, who admit a plenum, anſwer, that there are, properly ſpeaking, no generations: there are not ſeveral ſubſtances: the univerſe is a whole neceſſarily exiſting, inceſſantly diſplaying itſelf. It is one and the ſame being, whoſe nature is immutable in its ſubſtance, and eternally varied in its modifications. Thus the argument drawn from the ſucceſſion of beings, would perhaps prove very little againſt an atheiſt, who ſhould deny the plurality of beings. He would have recourſe to thoſe ancient axioms, that nothing is produced by nothing; that one ſubſtance cannot produce another; that every thing is eternal and neceſſary.

Matter, ſay the atheiſts, is neceſſary, becauſe it exiſts; motion is neceſſary, becauſe nothing is at reſt; and motion is ſo neceſſary, that in nature never any motive forces are loſt.

What is to day was yeſterday; therefore it was before yeſterday, and thus recurring without end. No perſon will dare to ſay, that things ſhall return to nothing; how then dare they to ſay that they came from nothing?

Dr. Clarke's whole book is not more than ſufficient to anſwer thoſe objections.

In a word, I know not whether there be a metaphyſical proof more ſtriking, and which ſpeaks more ſtrongly to man, than the admirable order reigning in the world; and whether there has ever been a finer argument than the following: *The heavens declare the glory of God.* Accordingly you ſee that Newton, at the end of his Optics and Principia, uſes no other. No reaſoning appeared to him more grand and convincing, in ſavour of a deity, than that of Plato, who makes one of his interlocutors ſay, you think I have an intelligent ſoul, becauſe you perceive order in my words and actions; ſurely then, from the order you ſee in this world, there muſt be in it a ſpirit ſupremely intelligent.

But if the exiſtence of an eternally almighty being be proved, it is not equally proved, that this being is infinitely good in the general ſenſe of the word.

This is the grand refuge of the atheiſt. If I admit a God, ſays he, this God muſt be goodneſs itſelf. He, who has given me being, ſhould alſo give me happineſs: but I ſee only diſorder and calamity among mankind. The neceſſity of an eternal matter offends me leſs than a creator dealing ſo harſhly with his creatures. My juſt complaints, my torturing doubts, continues he, are not to be removed by being told, that a firſt man, compoſed of a body and ſoul, offended his creator, and that mankind ſuffers for his offence. For 1ſt, if our bodies are derived from this firſt man, our ſouls are not; and even, if they are, it ſeems the moſt horrid injuſtice, for the puniſhment to deſcend from the fathers to the children. 2d, It ſeems evident that the Americans, and the people of the old world, the Negroes and the Laplanders, are not all deſcended from that firſt man. The interior conſtitution of the organs of the Negroes is a palpable demonſtration of this. No argument, therefore, can calm the murmurs ariſing in my heart againſt the evils that have overrun this globe. Thus I am forced to reject the idea of a ſupreme being; of a creator infinitely good, who has made infinite evils: and had rather admit the neceſſity of matter, generations, and eternal viciſſitudes, than a God, the free author of miſerable creatures.

To this atheiſt it is anſwered, the words *good*, *comfort*, and *happineſs* are equivocal; what is evil with regard to you, is good in the general plan. The idea of an infinite being, almighty, allwiſe, and omnipreſent, does not offend your reaſon. Will you deny a God becauſe you have been afflicted with a fever?

You ſay, he owed you happineſs: but what reaſon have you to think ſo? Why did he owe you this happineſs? Was you in any treaty with him? Therefore to be always happy in this life, you need only acknowledge a God. You who cannot pretend to be perfect in any one thing, how can you expect to be perfectly happy? But ſuppoſe that in a continual happineſs of a hundred years, you may have a fit of an head-ach; ſhall this ſhort interval of pain induce you to deny a creator? Surely no. If therefore you do not ſtartle at a quarter of an hour's ſuffering, why at two hours, why at a day? Why ſhould a year of torment prevail on you to reject the belief of a ſupreme and univerſal artiſan.

It is proved, that there is, in this world, more good than evil; for, after all, few men are to be found who really wiſh for death. You then unjuſtly prefer complaints in the name of mankind, and ſtill more ſo to deny your ſovereign, under pretence that ſome of his ſubjects are unhappy.

Men are fond of murmuring; there is a pleaſure in complaining, but more in living. We delight in viewing only evil and exaggerating it. Read hiſtory, it is replied; what is it more than a continual ſeries of crimes and misfortunes? Agreed; but hiſtories are only the repoſitories of great events: tempeſts only are recorded; calms are overlooked. We do not remember that, for this hundred years, there have not been a ſedition in Pequin, in Rome, in Venice, in Paris, in London; and that, in general there are in all great cities more quiet than tempeſtuous years, more harmleſs and ſerene days, than days diſtinguiſhed by great crimes and great misfortunes.

After examining the relations between the ſprings and organs of an animal, and the deſigns which diſplay themſelves in every part, the manner by which this animal receives life, by which he ſuſtains it, and by which he gives it; you readily acknowledge with admiration the ſupreme artiſt. Will you then change your opinion, becauſe wolves eat the ſheep, and ſpiders catch flies? Do not you, on the contrary, perceive, that theſe continual generations, ever devoured, and ever reproduced, are a part of the plan of the univerſe? Wiſdom and power, you anſwer, are perceiveable in them; but goodneſs is ſtill wanting. How! You breed creatures in a menagery and at a proper ſeaſon ſlay them; but muſt not be cenſured: while you accuſe the maſter of all animals of cruelty, becauſe he has made them to be eaten. In fine, if you may be happy to all eternity, can any pains and afflictions in this fleeting inſtant, called life, be worth mentioning? And if this eternity be not your portion, make yourſelf eaſy with this life which you ſo highly value.

You cannot think the creator *good*, becauſe there is ſome *evil* in the world. But if neceſſity ſupply the place of a ſupreme being; will affairs be mended? In the ſyſtem which admits a God ſome difficulties only are to be removed; in all the other ſyſtems we muſt encounter abſurdities.

Philoſophy indeed plainly ſhews us, that there is a God; but it cannot teach us what he is, what he is doing, how and wherefore he does it; whether he exiſts in time, or in ſpace; whether he has commanded once, or whether he is always acting, whether he be in matter, or whether he be not there; &c. &c. To himſelf only theſe things are known.

CHAP. II.

Of SPACE and DURATION, as PROPERTIES of GOD.

Opinions of Leibnitz. Opinions and reaſoning of Newton. Infinite matter impoſſible. Epicurus ſhould have admitted a God, creator and governor. Properties of pure ſpace and duration.

SPACE and duration are conſidered by Newton as two beings, whoſe exiſtence neceſſarily flows from God himſelf; for the infinite being is in every place; therefore every place exiſts: the eternal being laſts from all eternity, therefore an eternal duration is real.

Newton, in his queſtions at the end of his Optics, happened to aſk, "Do not theſe phenomena of nature "prove, that there is a being incorporeal, living, "intelligent, and omnipreſent; who, in infinite "ſpace, as in his *ſenſorium*, ſees, diſcerns, and "comprehends every thing in the moſt intimate, and "moſt perfect manner?"

The celebrated philoſopher, Leibnitz, who at firſt agreed with Newton, in regard to the reality of pure ſpace and duration, but ſome time after oppoſed him in every thing, and placed himſelf at the head of a different ſect in Germany, attacked theſe expreſſions of the Engliſh philoſopher, in a letter, written in 1715, to the late queen of England, conſort to George II. That princeſs, truly worthy of theſe correſpondence of Leibnitz and Newton, ſet on foot a regular diſpute by letters between the two parties; but Newton, being entirely averſe to all controverſy, and a very great œconomiſt of his time, permitted Dr. Clarke, his diſciple in philoſophy, and at leaſt his equal in metaphyſics, to enter the liſts for him. The diſpute turned upon almoſt all the metaphyſical ideas of Newton, and is perhaps the fineſt monument of literary conteſts exiſting.

Clarke began by juſtifying the compariſon taken from the *ſenſorium*, uſed by Newton. He lays it down as a principle, that no being can act, know, or peceive where it is not; now God acting and ſeeing every where, acts and ſees in every point of ſpace, which in this ſenſe alone may be conſidered as his *ſenſorium*, from the impoſſibility of expreſſing ourſelves in any language, when we preſume to ſpeak of God. Leibnitz affirmed ſpace to be nothing but the relation we cenceive between co-exiſtent beings. Nothing but the order of bodies, their arangement, their diſtances, &c. Clarke, after Newton, maintains, that if ſpace be not real, an abſurdity will follow. For if God had placed the earth, the ſun, and the moon, where the fixed ſtars are, provided the earth, the moon, and the ſun were in the ſame order with regard to each other as they now are, the conſequence would be, that the place then occupied by the earth,

the

the moon, and the ſun, would be the ſame with that they occupy at preſent; which is a contradiction in terms.

We are, according to Newton, to think the ſame of duration as of ſpace; that it is a reality; for were duration only an order of ſucceſſion between creatures it would follow, that what was doing to-day, and what was done a thouſand years ago, would, in reality, be done in the ſame inſtant. In fine, ſpace and duration are quantities, therefore ſomething very poſitive.

It is proper here to take notice of the following argument of the ancients, as it has never been anſwered: A man at the extremity of the univerſe holds out his arm: this arm muſt be in pure ſpace, for it is not in nullibiety; and if it be anſwered, that it is ſtill in matter, the world will then be infinite, and therefore in this ſenſe the world is God.

Pure ſpace then exiſts; a vacuum exiſts as well as matter, and exiſts even neceſſarily; whereas matter, according to Clarke, exiſts purely by the free will of the creator.

But, it will be ſaid, you admit an immenſe, an infinite ſpace; why not admit the ſame with regard to matter, as ſo many ancient philoſophers have done? Clarke anſwers: Space exiſts neceſſarily, becauſe God exiſts neceſſarily. It is immenſe; it is, like duration, a mode; an infinite property of a being neceſſarily infinite. Matter is not ſo; it does not exiſt neceſſarily; for was this ſubſtance infinite, it would be either an eſſential property of God, or God himſelf; but it is neither the one nor the other; therefore it is not, nor can be infinite.

It may be anſwered to Clarke: Matter may neceſſarily exiſt, without being on that account infinite; without being God: it exiſts becauſe it exiſts: It is eternal becauſe it exiſts to-day. A philoſopher is not to admit what he cannot conceive; nor can you either conceive the creation nor annihilation of matter. It may very well be eternal by its nature; and God may very well, by his nature, have the immenſe power of modifying it, though not that of making it from nothing: For to make a being from nothing is a contradiction; but there is no contradiction in believing matter neceſſary and eternal, and God neceſſary and eternal. If ſpace exiſts of neceſſity, matter alſo exiſts of neceſſity. You ought, therefore, to admit three beings; ſpace, whoſe exiſtence would be real, were there neither matter nor God; matter, which, as it could not have been formed from nothing, is neceſſarily in ſpace; and God, without whom matter could neither be organiſed nor animated.

Theſe difficulties Newton himſelf ſeems to obviate, at the end of his optics. He maintains, that ſpace neceſſarily flows from the exiſtence of God. God, properly ſpeaking, is neither in ſpace nor place; but God being neceſſarily every where conſtiſtutes, in that alone, immenſe ſpace and place. Thus duration, eternal permanence, follows indiſpenſibly from the exiſtence of God. He is neither in infinite duration, nor in time; but eternally exiſting; and thus he conſtitutes eternity and time. In this manner Newton explains himſelf; but this is not ſolving the problem. He ſeems fearful of owning, that God is in ſpace: he was afraid of diſputes.

Immenſe, extended, inſeparable ſpace, may be conſidered in ſeveral portions. For inſtance, the ſpace occupied by Saturn, is not the ſpace occupied by Jupiter; but theſe conceivable parts cannot be ſeparated; the one cannot be put in the place of the other, as one body may be put in the place of another. In the ſame manner, duration, infinite, inſeparable, and without parts, may be conceived in ſeveral portions; though to conceive one portion of duration put in the place of another would be an utter impoſſibility. Beings exiſt in a certain portion of duration, called time, and may exiſt in any other time; but a part conceived of the duration, any particular time, can only be where it is. The paſt cannot be the future.

Space and duration then, according to Newton, are two neceſſary and immutable attributes of the eternal and immenſe being. God alone can know all ſpace: God alone can know all duration. Some parts of ſpace, improperly ſo called, we meaſure by means of extended bodies which we touch: we meaſure parts of duration, improperly ſo called, by means of motions perceived by us.

But inſtead of entering here into a detail of the phyſical proofs reſerved for other chapters, let it ſuffice to obſerve, that in whatever concerns ſpace, duration, and the limits of the world, Newton followed the opinions of Democritus, Epicurus, and a crowd of philoſophers, as refined by our celebrated Gaſſendi. Newton has often declared to ſome French gentlemen ſtill living, that he eſteemed Gaſſendi as a very ſagacious, accurate, and prudent genius; and that he accounted it an honour in being entirely of his opinion, with regard to all the points we have been conſidering.

CHAP III.

Of Liberty in God, and of the Great Principle of a sufficient Reason.

Principles of Leibnitz. Carried perhaps too far. His reaſons very ſpecious. Anſwer. New inſtances againſt the principles of indiſcernables.

NEWTON hath affirmed, that God, both infinitely free, and infinitely powerful, has created many things, without any other reaſon for their exiſtence, than his mere will. For inſtance, that the planets ſhould revolve from weſt to eaſt, rather than otherwiſe; that there is ſuch a number of animals, ſtars, worlds, rather than any other; that the finite univerſe occupies ſuch or ſuch a point of ſpace, &c. The ſole reaſon of which is the will of the Supreme Being.

The famous Leibnitz embraced the contrary, and grounded his opinion on an antient axiom uſed by Archimedes; *Nothing is done without a cauſe, or a ſufficient reaſon*; and God has in all things done the beſt; becauſe if he had not done it as the beſt, there would have been no reaſon for doing it. But, ſay the Newtonians, there is no *better* in indifferent things. There are no indifferent things, anſwer the Leibnitians. Your idea leads to an abſolute fatality, ſaid Clarke: you make God a being acting from neceſſity, and conſequently a being purely paſſive; which is no longer God. Your God, replied Leibnitz, is a capricious artiſt, determining without ſufficient reaſon. The will of God is reaſon, returned the Engliſhman. Leibnitz inſiſted on his point, and puſhed it very forcibly in this manner:

No two bodies in nature are known to be entirely alike; nor is it poſſible they ſhould: for were they perfectly ſimilar, it would ſhew in God, who is almighty and all-productive, a want of fœcundity and power. Secondly, there would be no reaſon why the one ſhould occupy this place rather than the other.

The Newtonians anſwered: Firſt, it is falſe, that a ſimilarity in ſeveral beings would argue ſterility in the power of the creator; for if the elements of things muſt be abſolutely ſimilar to produce ſimilar effects; if, for inſtance, the elements of rays, eternally red with light, muſt be the ſame to form theſe red rays; if the elements of matter muſt be the ſame to form matter, this perfect reſemblance, this identity, is ſo far from being derogatory to the dignity of God, that it appears one of the fineſt evidences of his power and wiſdom.

Might I preſume to add any thing here to the arguments of a Clarke and a Newton, and might I take the liberty of diſputing againſt a Leibnitz, I would ſay, that it is only a being infinitely powerful that can make things perfectly alike. Whatever attention and labour may be employed by man in ſuch works, he will never attain it, becauſe his ſight will never be ſufficiently delicate to diſcern the inequalities in the two bodies. To make all the parts of one body ſimilar to thoſe of another, infinite minuteneſs muſt be ſeen: this, therefore can only be performed by an infinite Being.

Secondly, the Newtonians may alſo ſay, we fight Leibnitz with his own weapons. If the elements of things be all different; if the original parts of a red ray be not entirely alike; there is then no ſufficient reaſon why different parts always produce the ſame effect.

Thirdly, it may further be ſaid by the Newtonians, if one aſk a ſufficient reaſon why the atom A, is in one place, and the atom B, exactly ſimilar, is in another, the reaſon lies in the motion which impels them; and if we aſk the reaſon of this motion, you muſt either ſay, that this motion is neceſſary, or own that God began it. In fine, if it ſhould be aſked, why God began it, what other ſufficient reaſon can be given, than that God muſt have ordered this motion, to perform the works projected by his wiſdom? But why this motion rather to the right than to the left, rather weſtward than eaſtward; in this point of duration rather than another? — Muſt we not then recur to the will of the Creator? But is there a liberty of indifference? This we ſhall leave to the examination of every reflecting reader; and he will long examine, before he will be able to form a deciſion.

CHAP. IV.

Of Liberty in Man.

Excellent piece againſt liberty; ſo well written that Dr. Clarke made uſe of indecent language in his anſwer. Liberty of indifference. Liberty of ſpontaneity. Privation of liberty very common. Strong objections againſt liberty.

ACCORDING to Newton and Clarke, the infinitely free Being has communicated to man, his creature, a limited portion of that liberty; and by liberty here is not underſtood, the ſimple power of applying our thoughts to ſuch or ſuch an object, and of beginning the motion: not only the faculty of willing is meant, but that of willing in the moſt free and efficacious manner; and even of willing without any other reaſon than the will itſelf. There is not a man on the earth, who does not believe that he ſometimes feels himſelf poſſeſſed of this liberty. Many philoſophers, however, think the contrary; and that all the liberty we enjoy is, that of wearing ſometimes freely the fetters of fatality.

Among all the philoſophers who have written boldly againſt liberty, he who has indiſputably performed the taſk with moſt method, ſtrength and clearneſs, is Collins, an Engliſh gentleman, author of a diſcourſe on free-thinking, and ſeveral other works, equally bold and philoſophical.

Clarke, who was entirely of Newton's opinion, with regard to liberty, and who alſo maintained its right, both as a divine of a ſingular ſect, and as a philoſopher, anſwered Collins warmly, and mixed ſo much acrimony with his argument, as gave occaſion to thnk, that he felt at leaſt his adverſary's whole ſtrength. He charged him with confounding all ideas; becauſe Collins called man a neceſſary agent; Clarke ſays, if this be true, man is no longer an agent. But who does not ſee, that this is true chicanery? Whatever produces neceſſary effects, Collins calls a neceſſary agent. Is it of any conſequence whether he be called agent or patient? The point is to know whether he be neceſſarily determined.

If only one ſingle caſe can be found, where man is really free with a liberty of indifference, that alone ſeems ſufficient to decide the queſtion. Now what caſe ſhall we find more proper, than that where our liberty is put to a trial? For inſtance, it is propoſed to me to turn to the right or the left, or to do ſome other action, to which neither pleaſure attracts, nor diſguſt diverts. I then chuſe, and do not follow the dictates of my underſtanding, which repreſents to me the beſt; for in this caſe there is neither better nor worſe. How do I act? I exerciſe a right which God has given me of willing and acting in certain caſes, without any other reaſon than my own will. I enjoy a right and power to begin the motion, and begin it on which ſide I pleaſe. If in this caſe, my will alone directs me, why ſhould any other cauſe be ſought than my own will? It ſeems probable, therefore, that in indifferent things, we have the liberty of indifference. For who can ſay, that God has, or has not been able to confer on us this gift? And if he is able, and we feel this power in ourſelves, how can it be affirmed, that we do not enjoy it?

This liberty of indifference is, however, treated as a chimera: it is ſaid, that to determine without a reaſon, belongs only to madmen; but it ſhould be remembered that madmen are diſtempered perſons, without any liberty. They are neceſſarily determined by the diſorder of their organs. They are not their own maſters, they chuſe nothing. He is free, who determines for himſelf. Now why ſhall we not, in things indifferent, determine ourſelves merely by our own will?

We enjoy, in all other caſes, the liberty called ſpontaneity; that is, our will is determined by motives when there are any; and theſe motives are always the laſt reſult of the underſtanding, or inſtinct. Thus, when my underſtanding repreſents to itſelf, that it is better for me to obey than break the law, I conform to the law with a ſpontaneous liberty. I perform voluntarily what the laſt *dictamen* of my underſtanding leads me to perform. This ſpecies of liberty is never better perceived than when our will oppoſes our deſires. I have a violent paſſion for ſomething, but my underſtanding tells me, I muſt reſiſt this paſſion; it repreſents to me a greater good in victory, than in a compliance with my appetite. This laſt motive preponderates, and I oppoſe my deſires by my will. This command of my reaſon I neceſſarily and willingly obey; I do not what I deſire, but what I will; and, in this caſe, I am free, and enjoy all the liberty of which ſuch a circumſtance can make me ſuſceptible.

In fine, I am free in no reſpect, when my paſſion is too ſtrong, and my underſtanding too weak, or when my organs are diſordered; and this is unfortunately very often the caſe of men: ſo that ſpontaneous liberty is to the ſoul, what health is to the body; ſome perſons enjoy it entirely and conſtantly; many are often deprived of it, and others are ſick during their whole life: all other faculties of man are ſubject to the ſame variation. Sight, hearing, taſte, ſtrength, cogitation, are ſometimes ſtronger, and ſometimes weaker; our liberty, like every thing elſe, is limited, variable, in a word, very ~~trifling~~; becauſe man is himſelf inconſiderable.

The difficulty of reconciling the liberty of human actions with God's eternal preſcience, was no obſtacle to Newton; he avoided that labyrinth: liberty being once proved, it is not for us to determine how God foreſees what we ſhall freely do. We know not how God ſees what paſſes at preſent. We have no idea of his mode of ſeeing; why then ſhould we have any of his mode of foreſeeing? We ſhould conſider all his attributes as equally incomprehenſible.

It muſt be owned, that againſt this idea of liberty, there are objections which ſtartle. It is immediately ſeen that this liberty of indifference would be but a very trivial preſent, if it extended no farther than ſpitting to the right or left, or chuſing either odd or even. The buſineſs is whether Cartouche and Shah Nadir have a liberty of not ſhedding human blood. Of what conſequence is the liberty of putting the left or right foot forward? This liberty of indifference is then found to be impoſſible; for how can we be ſaid to determine without reaſon? You will; but why will you? You are aſked even or odd; you choſe even, without being aware of the motive, which is, that even preſents itſelf to your mind at the inſtant you make the choice.

Every thing has its cauſe: conſequently your will is not excepted. There is then no willing, but in conſequence of the laſt idea received. No perſon can know what idea he will have the next moment; therefore, no perſon is maſter of his own ideas; therefore, no perſon is maſter of willing or not willing. Were he maſter of theſe, he might perform the contrary of what God has diſpoſed in the concatenation of the things of this world. Thus every perſon might, and actually would change the eternal order.

It was on this accout that the wiſe Locke never mentioned the name of liberty; free-will ſeemed to him only a chimera. All the liberty he knew was, the power of doing what one wills. A patient during the paroxiſm of the gout has not the liberty of walking; nor the priſoner that of going abroad: the one becomes free when cured; the other on opening to him the gate.

To place theſe alarming difficulties in a ſtronger light, I will ſuppoſe that Cicero is attempting to prove to Cataline that he ought not to conſpire againſt his country. Cataline tells him it is out of his power; that his conferences with Cethegus, have imprinted in his mind the idea of the conſpiracy; that this idea pleaſes him beyond any other; and that we only will in conſequence of our laſt deciſion. But you might, anſwers Cicero, adopt other ideas as well as I, by liſtening attentively to me, and reflecting on the duty of conſulting the good of your country. It is of no conſequence, returns Cataline, your ideas offend me; and the deſire of aſſaſſinating you prevails. I am ſorry for your madneſs, ſays Cicero, endeavour to take ſome of my medicines. If I am mad, replies Cataline, I cannot command my endeavours to be cured. But, urges the conſul, men are endued with reaſon, which they may conſult, and may cure the diſorder of the organs, which renders you thus reverſe, thus hardened in ſo horrid a crime; eſpecially if this diſorder be not too ſtrong. Shew me, replies Cataline, the point where this diſorder is curable. For my part, I own, that from the firſt moment I began the conſpiracy, all my reflections have tended to make me perſervere in the undertaking. When did you firſt take this fatal reſolution? aſks the conſul. When I had loſt my money at play. And could not you have abſtained from play? No, for the idea of play predominated at that time in my mind above all other ideas: and had I not played, I ſhould have diſcompoſed the order of the univerſe, by which Quartilla was to win four hundred thouſand ſeſterces of me; with this money ſhe was to purchaſe a houſe and a gallant; by this gallant ſhe was to have a ſon; Cethegus and Lentulus were to come to my houſe, and we were to conſpire againſt the republic. Deſtiny has made me a wolf, and you a ſhepherd's dog: Deſtiny will decide which is to cut the throat of the other. To this Cicero could have anſwered only by an oration. It muſt, indeed, be allowed, that the objections againſt liberty can hardly be anſwered, but by a vague eloquence: a melancholy ſubject, on which the wiſer a perſon is, the more he fears, even to conſider it.

There is, however, one comfortable reflection, namely, that which ever ſyſtem we embrace, by what ever fatality we ſuppoſe all our actions are governed, we ſhall always act as if we were free.

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CHAP. V.

DOUBTS WITH REGARD TO THAT LIBERTY, CALLED THE LIBERTY OF INDIFFERENCE.

1. PLANTS are organized beings, in which every thing is done neceſſarily. Some plants belong to the animal kingdom, and are in effect animals attached to the earth.

2. Can theſe animal plants, with roots, leaves, and ſenſation, be ſuppoſed to have liberty? No ſurely.

3. Have not animals a perception, an inſtinct, a reaſon begun, a meaſure of ideas and of memory? What, in reality, is inſtinct? is it not one of thoſe ſecret ſprings we can never know? Nothing can be known but by analyſis, or a conſequence of what are called the firſt principles. Now what analyſis, or what ſyntheſis can explain the nature of inſtinct? We only perceive that this inſtinct is always neceſſarily accompanied with ideas. A ſilk worm has a perception of the leaf which nouriſhes it; the partridge of the worm which it ſeeks and ſwallows; the fox of the partridge which it eats; the wolf of the fox, which it devours. Now it is not very likely that theſe beings poſſeſs what we call liberty: may we not, therefore, have ideas without being free?

4. Men receive and combine ideas in their ſleep; but they cannot be ſaid to be then free. Is not this a

freſh proof, that we may have ideas without being free?

5. Man has, above other animals, the gift of a more comprehenſive memory: this memory is the ſole ſource of all his thoughts. Can this ſource, common to animals and men, produce liberty? The ideas of reflections in one brain, can they be any other than ideas of reflection in another?

6. Are not all men determined by their inſtinct? And is not this the reaſon why they never change their character? Is not this inſtinct what we call the diſpoſition?

7. Were we free, where is the man that would not change his diſpoſition? But was ever a man ſeen on earth, who gave himſelf one ſingle propenſity? Was there ever a man born with an averſion to dancing, that gave himſelf a taſte for dancing? a ſluggiſh and ſedentary man to ſeek motion? Do not age and a regimen diminiſh the paſſions which reaſon fancies it has ſubdued?

8. Is not the will the laſt conſequence of the laſt ideas received? If theſe ideas are neceſſary, is not the will alſo neceſſary?

9. Is liberty any thing more than the power of acting or not acting? and was not Locke in the right to call liberty, power?

10. A wolf has the perception of ſheep feeding in a meadow; his inſtinct prompts him to devour them; but is prevented by the dogs. A conqueror has the perception of a province, which his inſtinct leads him to invade; he finds fortreſſes and armies to obſtruct his paſſage. Where is the great difference between the wolf and the conqueror?

11. Does not this univerſe appear in all its parts ſubjected to immutable laws? If a man might, at his pleaſure, direct his will, is it not plain that he might diſcompoſe theſe immutable laws?

12. By what privilege ſhould man be exempted from the ſame neceſſity, to which the ſtars, animals, plants, and every thing elſe in nature are ſubjected?

13. Is it juſtly ſaid, that in the ſyſtem of this univerſal fatality, puniſhments and rewards would be

uſeleſs and abſurd ? Is it not rather evident that the inutility and abſurdity of puniſhments and rewards appear in the ſyſtem of liberty ? In ſhort, if a highwayman is poſſeſſed of a free will, determining itſelf ſolely by itſelf, the fear of puniſhment may very well fail of determining him to renounce robbery : but if the phyſical cauſes act alone ; if the ſight of the gibbet and wheel make a neceſſary and violent impreſſion ; they then neceſſarily correct the villain, while he is gazing at the execution of another.

14. To know whether the ſoul be free, ſhould not we firſt know what this ſoul is ? Can any one boaſt that his reaſon alone demonſtrates to him the ſpiritual nature, the immortality of the ſoul ? It is the general opinion of phyſicians, that the principle of ſenſation reſides in the place where the nerves unite in the brain. But this place is not a mathematical point. The origin of every nerve is extended. There is in that place a bell, on which the fine organs of our ſenſes ſtrike ; but who can conceive that this bell occupies no point of place ? Are we not automata ; born to will always, to do ſometimes what we will, and ſometimes the contrary ? Stars at the centre of the earth, without us, and within us, every eſſence, every ſubſtance is to us unknown. We ſee only appearances. We are in a dream.

15. Whether in this dream we believe the will free or ſubject ; the organiſed earth of which we are formed, endued with an immortal or periſhable faculty ; whether we think like Epicurus, or like Socrates, the wheels, that move the machine of the univerſe, will be always the ſame.

CHAP

CHAP VI.

OF NATURAL RELIGION.

Leibnitz's reproach of Newton, without foundation. Refutation of an opinion of Locke. The good of Society, natural religion, humanity.

LEIBNITZ, in his diſpute with Newton, reproaches him with giving very mean ideas of God, and of ſubverting natural religion. He pretends that Newton made God corporeal, and this imputation, as we have already ſeen, was founded on the word *ſenſorium*, or organ. He added that Newton's God in making this world had made a very aukward machine, which ſtood in great need of its being cleaned from its filth. Newton had ſaid, *manum emendatricem deſideraret*. This reproach is founded on Newton's having ſaid, that in length of time the motions will diminiſh, the irregularities of the planets increaſe, and the ſyſtem either periſh, or be again put in order by its author. It is evident from experience that God has made machines to be deſtroyed. We are the work of his wiſdom, and we periſh. Why then ſhould it be otherwiſe with the world? Leibnitz will have this world to periſh. But if God has formed it only to laſt for a certain time, its perfection then conſiſts in its laſting only till the inſtant fixed for its diſſolution.

As for natural religion, never was man more zealous for it than Newton, unleſs we except Leibnitz himſelf, his rival in ſcience and virtue. By natural religion I mean, the principles of morality, common to mankind. Newton indeed admitted no innate ideas, no ſentiments, no principles. He was, with Locke, perſuaded, that all our ideas proceed from the ſenſes, as they diſcloſe themſelves. But he believed, that God having given the ſame ſenſes to all men, the ſame wants, the ſame ſentiments; conſequently the ſame rude notions, every where the foundation of ſociety, prevail among all mankind. It is certain that God has given to bees and ants, ſomething to induce them to live in common, which he has not given to wolves nor falcons. It is certain, from all men's living in ſociety, there is, in their eſſence, a ſecret tye by which God intended to connect them together. Now if at a certain age the ideas, flowing from the ſenſes to men all organized in the ſame manner, did not gradually give them the ſame principles neceſſary to ſociety, it is certain that ſuch ſociety could not ſubſiſt. This is the reaſon why truth, gratitude, friendſhip, &c. are eſteemed from Siam to Mexico.

It has always ſeemed ſtrange to me, that ſo wiſe a man as Locke, in the beginning of his eſſay on human underſtanding, where he ſo effectually refutes innate ideas, ſhould have advanced, that there is no notion of good and evil common to all men. I believe this to be a miſtake. It is founded on the narratives of travellers, who ſay, that in ſome countries it is cuſtomary for parents to eat their children, and to eat women alſo when paſt child-bearing; that in others, certain enthuſiaſts, who make uſe of ſhe-aſſes inſtead of women, are honoured with the name of ſaints. But ſhould not ſuch a man as Locke have ſuſpected theſe travellers? There is nothing more common than for them to ſee through a falſe medium, give a falſe account of what they have ſeen, to miſtake the intention, eſpecially in a nation to whoſe language they are ſtrangers, and, in fine, to judge of the manners of a whole people by a particular fact, whoſe circumſtances are to them unknown.

Were a Perſian at Liſbon, at Madrid, or at Goa, on the day of an auto-da-fe, he would think, and not without an appearance of reaſon, that the Chriſtians ſacrificed men to God. Let him look into the almanacs, ſold all over Europe among the lower claſs, and he will conclude, that we all believe in the effects of the moon; though this is ſo far from being true, that we laugh at them. Thus ſhould a traveller tell me, for inſtance, that the ſavages eat their father or mother from filial affection, he will give me leave to anſwer him, that firſt the fact is very dubious; ſecondly, if it be true, it will be ſo far from deſtroying the idea of reſpect due to parents, that it is probably a barbarous manner of ſhewing tenderneſs; a horrible miſtake of the law of nature. For poſſibly they kill their parents from mere duty, to free them from the troubles of old age, or the ſury of an enemy: and if they thus give their parents a tomb within their own bodies, inſtead of being devoured by ſavage conquerors, this cuſtom, however ſhocking it may appear to human nature, neceſſarily flows from a goodneſs of heart. Natural religion is nothing more than this law known thro' the world, *do as you would be done by.* Now the ſavage, who kills his father to ſave him from the enemy, and who buries him in his breaſt, that he may not find a grave in the bowels of his enemy, wiſhes that his ſon may treat him in the ſame manner, if reduced to the ſame exigency. This law of treating our neighbour as ourſelves, flows naturally from the rudeſt notions, and ſooner or later is heard in the hearts of all men; for having all the ſame reaſon, the fruits of that tree muſt have a reſemblance; and they do, in reality, reſemble each other; for in every ſociety the name of virtue is given to whatever is thought uſeful to the ſociety.

Name me a country upon earth, or a company of ten perſons, where what tends to promote the common good is not eſteemed; and when you have done this, I will allow, there is no natural law. This law is, doubtleſs, infinitely varied; but can we infer from thence any thing more than that it exiſts? Matter every where receives different forms, yet every where retains its nature. It is in vain to ſay, that theft was enjoined at Lacedæmon; it is nothing more than an abuſe of words. What we call theft was not enjoined at Lacedæmon; but in a city where every thing was common, a permiſſion to take dexterouſly what private perſons appropriated to themſelves contrary to law, was a method of puniſhing the ſpirit of appropriation prohibited among that people. *Meum* and *Tuum* was a crime, for which what we call theft was the puniſhment; and among them, as among us, there was ſome order, made by God, as he has made the ants to live in ſociety.

Thus Newton was perſuaded, that this diſpoſition, which we all have for living in ſociety, is the foundation of the law of nature.

There is in man a diſpoſition to compaſſion equally general with our other inſtincts. Newton had cultivated this ſentiment of humanity, and even extended it to animals. He was, like Locke, firmly perſuaded, that God had given to animals (however they might ſeem to be only matter) a meaſure of ideas, and the ſame ſenſations with ourſelves. He could not think that God, who does nothing in vain, could have given to beaſts organs of ſenſation, that they might have no ſenſation.

To believe that beaſts feel, and to make them ſuffer, appeared to him a moſt horrid contradiction; and his morality in this reſpect was conformable to his philoſophy. It was even with regret that he complied with the barbarous cuſtom of feeding on the blood and fleſh of beings like ourſelves, whom we daily careſſed; and in his houſe he never allowed them to be put to a lingering or uncommon death, to render their fleſh more delicious.

This compaſſion for animals was improved towards mankind into the nobleſt benevolence. Indeed without humanity, a virtue which includes all virtues, we ſhould very ill deſerve the name of philoſophers.

CHAP. VII.

OF THE SOUL, AND ITS MANNER OF UNION WITH THE BODY, AND HOW IT RECEIVES ITS IDEAS.

Four opinions on the formation of ideas. Thoſe of the ancient materialiſts. That of Malebranche. That of Leibnitz. Confutation of the opinion of Leibnitz.

NEWTON, like almoſt all true philoſophers, was perſuaded, that the ſoul is an incomprehenſible ſubſtance; and ſeveral perſons, who have converſed with Locke, have aſſured me, that Newton owned to Locke, "that we have not a ſufficient knowledge of "nature, for us to dare to affirm, that it is impoſſible to

" God to add the gift of thought to any extended ſub-" ſtance whatſoever. But the great difficulty is rather to know how any being whatever can think, than to know how matter can become cogitative. Thought, indeed, ſeems to have nothing in common with the known attributes in that extended being which we call body. But are we acquainted with all the properties of bodies? Does it not ſeem very bold to ſay to God, you have been able to give a being motion, gravitation, vegetation, and life; but cannot give it thought?

They who ſay, that if matter could receive the gift of cogitation, the ſoul would not be immortal, ſeem to have drawn an unfair conſequence. Is it more difficult for God to preſerve than to make? Beſides, if an inſecable atom be eternal, why ſhall not the faculty of cogitation it enjoys laſt as long? If I am not miſtaken, they, who deny God to have the power of annexing ideas to matter, are forced to ſay, that what we call ſpirit is a being whoſe eſſence is to think, excluſive of any extended being whatever. Now if it be the nature of ſpirit to think eſſentially, then it thinks neceſſarily and thinks inceſſantly, as every triangle has neceſſarily and always three angles independently of God. How! on God's creating ſomething, which is not matter, muſt that ſomething abſolutely think? Weak and bold as we are, do we know whether God has not formed millions of beings, which have neither the properties of ſpirits nor matter as known to us? We are like a herdſman, who having ſeen no other beaſts than oxen, ſhould ſay, *if God pleaſes to make other beaſts, they muſt have horns and chew their cud.* Which will be thought more reverential to the deity to affirm, that there are beings without the divine attribute of cogitation abſtractedly from him, or to apprehend that God can grant that attribute to any being he ſhall pleaſe to chuſe? This alone ſhews the injuſtice of thoſe who have charged that opinion on Locke as a crime, and, with a cruel malignity, employed the weapons of religion againſt an idea merely philoſophical.

It muſt be obſerved, that Newton was very far from venturing to define the ſoul, as ſo many others have preſumed to do; he thought it was poſſible there might be millions of other thinking beings, whoſe nature might be entirely different from that of our ſoul; ſo that the diviſion of all nature into matter and ſpirits, ſeems the definition of a deaf and blind man defining the ſenſes, without any idea or conception of ſight or hearing. How, indeed, can any one ſay that God has not filled the immenſe ſpace with an infinity of ſubſtances, having nothing in common with mankind.

Newton had not formed to himſelf any ſyſtem on the manner in which the ſoul is united to the body, and the formation of ideas. An enemy to ſyſtems, he judged only from analyſis; and when that light was wanting he proceeded no farther.

Hitherto four opinions have prevailed concerning the formation of ideas; the firſt is that of almoſt all the ancient nations, who, conceiving nothing beyond matter, looked on ideas in our underſtanding as the impreſſion of the ſeal on wax. This perplexed opinion was rather a rude inſtinct than ratiocination. Succeeding philoſophers, who were for proving that matter thinks of itſelf, have erred ſtill more: the vulgar were miſtaken without any previous reaſoning, theſe erred from principles; not one of them being ever able to diſcover any thing in matter, that tended to prove it was intelligent. Locke alone appears to have removed the contradiction between matter and thought, recurring at once to the creator of all thought, and of all matter, and modeſtly ſaying, "Cannot he, who can do every thing, give cogitation to a material being, to an atom, to an element of matter?" He ſtopped at this poſſibility as became a man of his wiſdom. To affirm that matter does actually think, becauſe God could impart ſuch a faculty to it, would be the higheſt preſumption; but is it leſs to aſſert the contrary?

The ſecond, and moſt generally received opinion, is that, which conſiders the ſoul and body as two diſtinct and quite different beings, created by God to act on each other. The only proof of this reciprocal action

tion is the experience, which every one believes to have of it; we feel our bodies ſometimes obeying our will, and ſometimes tyrannizing over it: we conceive that they in reality act on each other, becauſe we feel it, and we cannot carry our inveſtigations farther. An objection, however, lies againſt this ſyſtem, not eaſily removed: an external object, for inſtance, communicates a vibration to the nerves, which motion either extends to the ſoul or not; if it reaches the ſoul, it imparts motion to it, which would ſuppoſe the ſoul to be corporeal; if it does not, there is no longer any action. All the anſwer that can be given is; this action is one of thoſe things, the mechaniſm of which will for ever remain unknown: a ſad concluſion; but almoſt the only one becoming man in more than one point of metaphyſics.

The third ſyſtem is the occaſional cauſes of Deſcartes, carried ſtill farther by Malebranche. He begins with ſuppoſing that the ſoul can have no influence on the body, and in this goes immediately too far; for though the influence of the ſoul on the body be inconceiveable, it does not therefore follow, that it is impoſſible: he then ſuppoſes that matter, as an occaſional cauſe, makes an impreſſion on our body; and in conſequence of that impreſſion, God produces an idea of our ſoul; and reciprocally, man produces an act of volition, and God acts immediately on the body, in conſequence of that volition. Thus man acts and thinks only in God; which, I think, admits of no other explanation, than that God alone acts and thinks for us. This hypotheſis abounds with ſuch difficulties, that the reflective mind labours in vain for a ſolution; for how, according to this ſyſtem, can a man will of himſelf, without having the power to think of himſelf? If God has not given us the faculty of producing motion and ideas, if it is he alone who acts and thinks, it is he alone who wills. In this caſe we are not only without liberty, but we are nothing, or we are modifications of God himſelf. In this caſe there is no longer a ſoul, an intelligence in man; the union of the ſoul and body need not be any longer conſidered; there is no ſuch thing, and God alone exiſts.

The fourth ſentiment is the pre-eſtabliſhed harmony of Leibnitz. According to this hypotheſis, the ſoul has no intercourſe with its body: they are two clocks made by God, each has its ſpring, and goes for a certain time in perfect agreement; one points the hours, the other ſtrikes. The clock which ſhews the hour does not ſhew it, becauſe the other ſtrikes; but God has ſo determined their motions, that the hand or index, and the chimes, may always agree. Thus the ſoul of Virgil produced the Eneid, and his hand wrote the Eneid, without this hand in the leaſt obeying the intention of the author; but God had, from everlaſting, ordained that the ſoul of Virgil ſhould make verſes, while a hand annexed to Virgil's body ſhould reduce them into writing. Not to mention the extreme difficulty which here alſo occurs in reconciling liberty with this pre-eſtabliſhed harmony, a very ſtrong objection is, that if, according to Leibnitz, nothing is done without a ſufficient reaſon taken from the foundation of things, what reaſon had God to unite two incommenſurables, two beings ſo heterogeneous, ſo infinitely different as the ſoul and body, and the one having no manner of influence on the other? My ſoul might as well have been placed in Saturn as in my body; the union of the ſoul and body becomes utterly needleſs and ſuperfluous; but the reſt of Leibnitz's ſyſtem is ſtill more extraordinary; the fundamental principles of it may be ſeen in the ſupplement to the Leipſick acts, vol. VII. and the ample comments on them by ſeveral Germans, in a method entirely geometrical, may be conſulted.

According to Leibnitz there are four ſorts of ſimple beings, which he termed *monades*, as will be ſeen in chap. IX. We ſhall here ſpeak only of that kind of *monade*, called our ſoul. The ſoul, ſays he, is a concentration, *a living mirrour of the whole univerſe*, having confuſed ideas of all the modifications of this world, paſt, preſent, and to come. Newton, Locke, and Clarke, on hearing ſuch an opinion, expreſſed the greateſt contempt of it, as if Leibnitz was not the author; but very great philoſophers among the Germans have thought it worth their while to explain what no Engliſhman ever thought worth conſidering. I cannot avoid exhibiting this hypotheſis of the celebrated Leibnitz, which is the more reſpectable to me, ſince it has become an object of your inquiries. Every ſimple created being, ſays he, is ſubject to change, otherwiſe it would be God. The ſoul is a ſimple created being, conſequently cannot remain in the ſame ſtate; but bodies being compounded, can make no alteration in a ſimple being: the ſource then of its variations muſt be placed in its own nature. Its changes then are ſucceſſive ideas of the things of this univerſe; ſome are clear; but all the things of this univerſe, ſays Leibnitz, have ſuch a mutual dependence, are ſo eternally connected together, that if the ſoul has a clear idea of one of thoſe things its ideas of all the other are neceſſarily obſcure and confuſed. This opinion may be illuſtrated by the example of a man, who has a clear idea of a game, at the ſame time he has many confuſed ideas of ſeveral combinations of this game. A man who has, at preſent, a clear idea of a triangle, has an idea of ſeveral properties of the triangle. which may afterwards preſent themſelves ſucceſſively to his mind more clearly. In this ſenſe "it "is, *that the monade of man is a living mirrour of this "univerſe.*"

It is eaſy to anſwer, that if God has made a looking-glaſs of the ſoul, he has made a very dull one; and if there be no other reaſon for advancing ſuch ſtrange ſuppoſitions, than his pretended indiſpenſible connection between all the things of the preſent world, this bold ſtructure is erected on ſecret foundations; for when we have a clear idea of a triangle, it is becauſe we have a ſufficient knowledge of the eſſential properties of a triangle; and if the ideas of all theſe properties do not ſuddenly offer themſelves clearly to our mind, they are included in that clear idea, there being a neceſſary relation or conformity between the one and the other. But is this the caſe with regard to the whole aſſemblage of the univerſe?——Take away one property from the triangle, and you take away all: But does the taking away a grain of ſand from the univerſe, occaſion an entire change in the remainder? If among a hundred millions of beings followed by pairs, the two firſt change places do the others alſo neceſſarily change? Does not the ſame relation ſtill ſubſiſt between them? Beſides can the ideas of a man be ſaid to have the ſame concatenation as is ſuppoſed to ſubſiſt between the things of this world? What connection, what neceſſary medium is there between the idea of night, and the unknown objects I behold on my waking? What connection is there between the tranſitory death of the ſoul, in a profound ſleep, or a ſwoon, and the ideas received on our waking or recovery?

Every being in this univerſe, is undoubtedly related to the univerſe; but it is not every action of every being, that is the cauſe of events in the world. The mother of Brutus, in bringing him into the world, was one of the cauſes of Cæſar's death; but her ſpitting to the right or left, was of no conſequence to Rome. There are events which are at once both effect and cauſe. There are a thouſand actions which are only inconſequential effects. The vanes of a windmill turn round, and by their motion cauſe the grain, by which man is nouriſhed, to be ground: This is both an effect and cauſe. A few particles of duſt fly from it; this is an inconſequential effect. A ſtone, thrown into the Baltic ſea, produces no effect in the Indian ocean; a thouſand effects produce nothing, like the motion in fluids.

Were it even poſſible that God ſhould have made all that Leibnitz imagines; muſt we believe it on a bare poſſibility? What has he proved by all theſe freſh efforts? Nothing more than that he had a very great genius. But has he given either himſelf or others any light? Strange! we know not how the earth produces a blade of graſs; how a woman conceives a child; and yet we pretend to know how ideas are produced!

If it be aſked, what thoughts Newton entertained with regard to the ſoul, the manner of its operations, and which of all theſe ſentiments he embraced? I anſwer he eſpouſed none. What then did he, who had ſubjected infinity to calculation, and diſcovered the laws of gravity know on this ſubject? He knew where to doubt.

CHAP. VIII.

OF THE FIRST PRINCIPLES OF MATTER.

Examination of the firſt Matter. Newton *miſtaken. No real Tranſmutations.* Newton *admits of Atoms.*

IT is our buſineſs to examine which ſyſtem was moſt ridiculous; that which conſidered water as the principle of all things, that which attributed every thing to fire, or that which ſuppoſes cubes placed in contact with each other, without any interſtices, and turning I know not how on themſelves.

The moſt plauſible has ever been, that there is a firſt matter abſolutely indifferent, uniform and capable of all ſhapes, and being differently combined, conſtitutes this univerſe. The elements of this matter are the ſame acquiring its modifications from the moulds through which it paſſes; as a metal infuſion becomes ſometimes an urn, ſometimes a ſtatue. This was Deſcartes's opinion, and perfectly agrees with the chimera of his three elements. Newton, in this reſpect followed Deſcartes; but he arrived at this concluſion another way. As he very ſeldom formed a judgment that was not grounded either on mathematical or experimental proof; ſo, in this inquiry he thought, himſelf ſupported by experience. The celebrated Mr. Boyle, the founder of experimental philoſophy in England, had kept water a long time in a retort, expoſed to an equal degree of heat; and the chemiſt, who performed his experiments, imagined that the water was at laſt changed into earth. But the fact was otherwiſe as has ſince been proved by Boerhaave, who was at once an accurate naturaliſt and ſkilful phyſician. The water had evaporated, and the earth found in the veſſel, came from elſewhere.

How are experiments to be miſtruſted, after impoſing on Boyle and Newton! Thoſe great philoſophers were perſuaded, that the primitive particles of water change into particles of earth; the elements of things are only the ſame matter differently arranged. Had not a falſe experiment miſled Newton to this concluſion, he would, perhaps, have reaſoned quite otherwiſe. I would beg the reader's attention to what follows.

The only method of reaſoning on objects, ſuitable to man, is analyſis. To begin with the firſt principles, belongs only to God. And if we may, without blaſphemy, compare the divine being to an architect, and the univerſe to an edifice; where is the traveller who had ſeen only part of the outſide of the building, would immediately imagine he was able to diſplay all the art and contrivance within? Yet have not almoſt all philoſophers, with a thouſand times greater temerity, dared to do even more than this? Let us then examine this edifice as far as we are able. What do we meet with around us? Animals, vegetables, minerals (including under the latter all ſalts, ſulphurs, &c.) earth, ſand, water, fire, air, and nothing elſe, at leaſt hitherto known..

Before I proceed to examine whether thoſe bodies are mixed or not, I aſk myſelf, whether it be poſſible, that a matter, ſuppoſed uniform, which in itſelf is nothing that exiſts, can be productive of every thing that does exiſt?

I. What is a firſt matter, which is different from all the things in this world, and yet produces them all? It is ſomething of which I can have no idea, and therefore, am not to admit. I cannot, indeed, form to myſelf the general idea of an extended, impenetrable, ductile ſubſtance, without thinking of ſand, earth, gold, &c. Yet either this matter is really one of thoſe things, or it is nothing at all. In like manner I can think on a triangle in general, without fixing on the equilateral, the ſcalenous, the iſoceles, &c. but a triangle exiſting muſt be one of theſe. This reflection alone, thoroughly weighed, is perhaps ſufficient to exclude the opinion of a firſt matter.

II. Were any matter whatever put into motion, ſufficient to produce all the objects we behold on the earth; I ſee no reaſon why duſt, well ſhaken in a caſk, might not produce men and trees; nor why a field, ſown with grain, might not produce whales and crabs as well as wheat. It is of no conſequence to ſay, that the moulds and ſtrainers of the ſeed prevent it; for we muſt always return to this queſtion, where are theſe moulds, theſe ſtrainers, ſo invariably determined? Now, if no motion, no art, can produce fiſhes in a field inſtead of corn, medlars inſtead of a lamb in the belly of an ewe; roſes on the top of an oak; nor ſoles in a beehive, &c. If all the ſpecies be invariably the ſame, have not I ſome reaſon to conclude, that all the ſpecies have been determined by the ſovereign of the world; that there are as many deſigns as there are different ſpecies; and that matter and motion, without theſe deſigns, would produce only an eternal chaos?

I am confirmed in this ſentiment by univerſal experience. If I examine on one hand a man and a ſilk-worm, and on the other a bird and a fiſh; I ſee they were all formed at the very beginning of things: An unfolding is all that I perceive in them. The unfolding of man, and the unfolding of the inſect, agree in ſome particulars, and differ in others. It is the ſame with regard to that of the fiſh and the bird. Man, before he is received into the matrix of his mother, is a worm. He becomes a chryſalis, a nympha in the uterus, while infolded in that wrapper called the omentum. He comes out of it with legs and arms, as the worm, when grown to a fly, quits its ſepulchre with wings and feet; like the inſect he live ſome days, and then both bodies diſſolve. Among the reptiles, ſome are oviparous and others viviparous. The female of fiſhes is prolific, without the approaches of the male, who only paſſes over the eggs that have been depoſited, to hatch them. Vinefretters, oiſters, &c. propagate their ſpecies without the mixture of the two ſexes. Polypuſſes have the power of replacing their heads when cut off. The claws of lobſters are known to be reproduced. But the formation of vegetables and minerals is entirely different. Every ſpecies of being is a diſtinct world; and ſo far is blind matter from producing every thing by mere motion that in all appearance, God has formed an infinity of beings, with infinite means, he being infinite himſelf.

Theſe are my firſt conjectures on taking a view of nature: but when I enter into a detail, when I proceed to examine every thing by experiment, the reſult is this: I ſee mixed bodies, ſuch as vegatables and animals, which I analyze, and draw from them ſome groſs elements, as ſpirit, phlegm, ſulphur, caput mortuum. Other bodies there are, ſuch as metals and minerals, whence nothing can be drawn, except their own parts more attenuated. From pure Gold I have never been able to draw any thing but gold; it is the ſame with mercury. None have been able to change ſand, mud, pure water, into any other ſpecies of beings. What therefore can I hence infer, but that vegetables and animals are compoſed of thoſe other primitive beings which can never be analyzed. Theſe primitive unalterable beings are the elements of bodies; the man and the fly are then a compound of mineral particles of ſand of mud, fire, air, water, ſulphur, ſalt; and all thoſe primitive parts, which can never be decompounded, are elements, each having its peculiar and invariable nature.

He, who affirms the contrary, ſhould have ſeen tranſmutations. But who, with all the helps of chemiſtry, has ever diſcovered any? Is not the philoſopher's ſtone conſidered by all wiſe men as an impoſſibility? Is it more poſſible in the preſent ſtate of this world, that ſalt be changed into ſulphur, water into air, air into fire, than to make gold by the help of the powder of projection?

Have not men who believe tranſmutations, properly ſo called, been deceived by appearances, like thoſe who thought the ſun moved? For on ſeeing corn and water converted in human bodies to blood and fleſh, who would not have believed tranſmutation? Yet what is all this but ſalts, ſulphurs, phlegm, &c. differently arranged in the corn and in the human body? The more I reflect on this, the more a metamorphoſis, taken in the in the ſtricteſt ſenſe, appears to me a contradiction in terms. I believe two things are requiſite to change the primitive parts of ſalt into the primitive parts of gold, to annihilate the elements of ſalt, and create the elements of gold. Such is the reality of thoſe pretended metamorphoſes of a homogeneous and uniform matter, though hitherto admitted by ſo many philoſophers. My proof is this.

It is impoſſible to conceive the immutability of ſpecies unleſs compoſed of unalterable principles. For if theſe principles, theſe original conſtituent parts, can never change, they muſt be perfectly ſolid, and conſequently always of the ſame figure. If they are ſuch, they cannot be compoſed of other elements: for they muſt then receive other figures; therefore in the preſent conſtitution of things, it is impoſſible that the element of ſalt ſhould be changed into the element of mercury.

It is ſomething ſtrange, that Newton, who admitted of atoms, ſhould have overlooked ſo natural an induction. He, like Gaſſendi, admitted of real atoms in diviſible bodies; but he arrived at this aſſertion by the mathematics; at the ſame time, he thought theſe atoms, theſe indiviſible elements, were continually changing one into the other. Newton was a man; and therefore like us, ſubject to error.

It will doubtleſs be aſked, how the germs of things being hard and indiviſible, grow and extend themſelves? Probably, it is performed only by aſſemblage, by contiguity; ſeveral atoms of water form a drop, and the like may be ſaid of the reſt.

It ſtill remains to know how this contiguity is performed; how the parts of bodies become mutually connected together. This perhaps is one of the ſecrets of the creator, which will ever remain unknown to men. How the conſtituent particles of gold form a lump of that metal, cannot, I think, be known, without ſeeing thoſe particles.

If I ſay that attraction is probably the cauſe of this adheſion and continuity of matter, it is only becauſe nothing more plauſible can be advanced; for as it can be demonſtrated that all the parts of matter gravitate on each other, whatever the cauſe be, can any thing more natural be imagined, than that bodies, touching each other in moſt points, are, by the force of ſuch gravitation, cloſely connected?

But this is not the place for enlarging on this phyſical article.

CHAP. IX.

Of the Monades, or the Nature of the Elements of Matter.

Opinion of Newton. *Opinion of* Leibnitz.

IF ever *audax Japeti genus* may be truly ſaid, it is with regard to man daring to inquire into the firſt elements, which ſeem placed at an infinite diſtance from the ſphere of our capacities. Nothing, perhaps, is more modeſt than the opinion of Newton, who went no farther than to apprehend that the elements of matter are matter; that is, an extended and impenetrable being, whoſe intimate nature the human intellect cannot penetrate; that God can divide it *ad infinitum*, as he can annihilate it; but keeps its parts extended and inſeparable, as a baſis to all the productions of the univerſe.

On the other hand, nothing, perhaps, can exceed the boldneſs of Leibnitz's flight, in ſetting out with his principle of *a ſufficient reaſon* to penetrate, if poſſible, into the very boſom of cauſes, and into the inexplicable nature of thoſe elements. All bodies, ſays he, are compoſed of extended parts: but of what are theſe extended parts compoſed? They are, continues he, actually diviſible, and divided *ad infinitum*; thus extenſion is ever all you meet with. Now to ſay, that extenſion is the *ſufficient reaſon* of extenſion, is arguing in a circle, it is ſaying nothing; therefore the reaſon, the cauſe of extended beings muſt be ſought for in beings which are not ſo, in ſimple beings, in Monades; thus, matter is nothing but an aſſemblage of ſimple beings. We have ſeen in the chapter of the ſoul, that according to Leibnitz, every ſimple being is ſubject to change; but its changes, its determinations, which it ſucceſſively receives, cannot proceed from without, as this being is ſimple, intangible, and occupies no place; it ha then within itſelf the ſource of all its changes, p duced by external objects; it has therefore ideas. But it has a neceſſary relation to all the parts of the univerſe, it has therefore ideas relative to the whole univerſe. The elements of the vileſt excrements therefore have an infinite number of ideas. Their ideas, indeed, are none of the cleareſt; they are deſtitute of *Apperception*, as Leibnitz expreſſes himſelf; they have not in themſelves the inward teſtimony of their thoughts, but they have confuſed perceptions of the preſent, the paſt, and the future. He admits four kinds of Monades.

I.

The elements of matter, which have no diſtinct thoughts.

II.

The Monades of beaſts, which have ſome clear ideas, though none diſtinct.

III.

The Monades of finite ſpirits, which have confuſed, clear, and diſtinct ideas.

IV.

Laſtly, the Monade of God, with only adequate ideas.

I have already obſerved, that the Engliſh philoſophers, with whom names go for nothing, have anſwered the premiſes only with ridicule; but it is by ratiocination alone that I muſt refute Leibnitz. Methinks I might take the liberty of ſaying to thoſe who have countenanced ſuch opinions, all the world agrees with you in the principle of *ſufficient reaſon*; but is the conſequence you draw from it here very juſt?

I.

You hold matter to be infinitely diviſible, and yet the ſmalleſt part is not to be found; there is none which has not ſides and figures, and which does not fill a place; how then will you have it formed only of beings, without ſides, place, or figure? Do you not treſpaſs againſt the great principle of *contradiction*, in tenaciouſly following that of *ſufficient reaſon?*

II. Is

II.

Is it ſufficiently reaſonable that a compound ſhould have nothing ſimilar to that of which it is compoſed? Nothing ſimilar, do I ſay? the difference is infinite between a ſimple and an extended being, and you will inſiſt that one is made of the other! Would it be more offenſive to reaſon to ſay, that ſeveral elements of iron form gold, and the conſtituent particles of ſugar make coloquintida?

III.

Can you preſume to affirm, that a drop of urine is an infinitude of Monades, and that each has ideas, though obſcure ones, of the whole univerſe? and this becauſe, according to you, there is a *plenum*, and becauſe in this *plenum* every thing is conjoined, becauſe every thing being conjoined, and a Monade having ideas neceſſarily, it cannot have a perception which does not relate to every thing in the world?

Yet ſuch are the things, in the explication of which lemmas, theorems, and corallaries have been drawn, and what have they proved? what Cicero ſaid, 'that there is nothing ſo ſtrange which has not been maintained by philoſophers.' O metaphyſics! we are now juſt as far advanced as in the time of the firſt druids.

CHAP. X.

OF THE ACTIVE FORCE THAT GIVES MOTION TO EVERY THING IN THE UNIVERSE.

Whether there be always the ſame Quantity of Force in the World. Examination of Force. Manner of calculating Force. Concluſion of both Parties.

I Suppoſe it is agreed, that matter can have no motion of itſelf; it muſt therefore receive it from elſewhere; but it cannot receive it from other matter, as that would imply a contradiction: motion therefore muſt proceed from an immaterial cauſe. God is that immaterial cauſe. But here the utmoſt care muſt be taken, that this vulgar axiom, 'a philoſopher muſt never have recourſe to God,' has place only in things that may be explained by phyſical proximate cauſes. For inſtance, I am to explain why a four pound weight is counterpoiſed by a pound weight; if I ſay that God has appointed it ſhould be ſo, I ſhould betray my own ignorance; but I ſay, it is becauſe the one pound weight is four times farther from the centre of motion than the four pound weight. It is otherwiſe with regard to the firſt principles of things: in that caſe not to have recourſe to God, is a mark of ignorance; for either there is no God, or no firſt principles but in God.

It is he that impreſſed on the planets that force by which they move from weſt to eaſt: it is he who cauſed the planets and the ſun to revolve on their own axes. He has impreſſed a law on all bodies, by which they all equally tend to their centre. He has alſo formed animals, to whom he has given an active force, whereby they produce motion.

The great queſtion is to know, whether this force or power given by God to begin motion, is, in nature, always the ſame.

Deſcartes, without making any mention of force, advanced, without the leaſt proof, that there is always an equal quantity of motion; and his opinion was the worſe founded, as he was an abſolute ſtranger to the very laws of motion. Leibnitz, who lived in more enlightened times, has been obliged to acknowledge, in conformity to Newton, that motion diminiſhes; but at the ſame time pretended, that though the ſame quantity of motion does not ſubſiſt, the force is always the ſame. Newton, on the contrary, conſidered it as a contradiction to ſuppoſe, that the motion was not in proportion to the force.

Previous to any mechanical diſcuſſion of this ſubject, we muſt conſider the nature of things; for here the geometrician muſt ſubmit to follow the metaphyſician. A man has a certain quantity of active force; but where was this force before his birth? If it be ſaid that it reſided in the germ of the fœtus, of what conſequence is a power that cannot be exerted? but when he is grown up to manhood, does he not enjoy a freedom of acting? cannot he exert more or leſs of this force? Suppoſe he exerts a force of three hundred pounds in moving a machine; I will ſuppoſe, as it is poſſible, the force is applied to a lever, and that the machine annexed to this lever, is in an exhauſted receiver; the machine may eaſily acquire a force of two thouſand pounds. The operation being finiſhed, the arm withdrawn, the lever taken away, the weight without motion; I would aſk, whether the little matter that remained in the receiver, had acquired, from the machine, a force of two thouſand pounds? Do not all theſe conſiderations tend to ſhew, that the active force is continually recruited and continually diminiſhed in nature?

Let us now, to terminate this metaphyſical diſpute, liſten to Newton and experiment. Motion, ſays that philoſopher, is produced and loſt; but from the tenacity of the fluids, and the little elaſticity of the ſolids, the loſs of motion in nature greatly exceeds the reproduction. This admitted, if we conſider the following undoubted axiom, that the effect is always proportionable to the cauſe, it will follow, that where motion diminiſhes, there muſt alſo be a dimunition of force.

Therefore, if the ſame quantity of force be always in the univerſe, this maxim, that *the cauſe is proportionable to the effect*, can be no longer true.

It has been imagined that, in order to preſerve in nature this equality of force, it was ſufficient to alter the manner of eſtimating this force: thus, as Merſenne, Deſcartes, Newton, Mariotte, Varignon, &c. have always followed Archimedes, in meaſuring the force of a body, by multiplying its maſs by its velocity; ſo the followers of Leibnitz, Bernoulli, Herman, Poleni, Graveſande, Wolf, &c. have multiplied the maſs by the ſquare of the velocity *.

This diſpute, to the ſcandal of geometry, has divided Europe; but appears at length to be, in reality, only a diſpute about words. It is indeed impoſſible that theſe eminent philoſophers, though abſolutely oppoſite, ſhould be miſtaken in their calculations. Both are equally juſt; the mechanical effects anſwer equally to both methods of computation. There is then undoubtedly one ſenſe in which they are all in the right. Now, that point, where they all coincide, is that which ſhould reconcile them, and this was firſt indicated by Dr. Clarke, in the following manner.

If you conſider the time in which the moving body acts, its force at the end of this time, is as the ſquare of the velocity multiplied by the maſs. Why? becauſe the ſpace paſſed over by the body, is as the ſquare of the time in which it is paſſed over. Now the time is as the velocity; therefore the body, which, in this time, has paſſed over this ſpace, at the end of this time, acts in proportion to the maſs multiplied by the ſquare of its velocity; thus when the body 2, paſſes in 2 times any ſpaces whatever, with 2 degrees of velocity, at the end of this time its force is 2, multiplied by the ſquare of its velocity 2; which makes 8, and the body makes an impreſſion as 8: in this caſe the followers of Leibnitz are not in the wrong. But the followers of Deſcartes and Newton united, are alſo right, when they conſider the problem in another point of view; for they ſay, that in an equal time a body of four pounds with one degree of velocity, acts preciſely as a pound weight with four degrees of velocity; and elaſtic bodies, impinging on one another, recoil always in a reciprocal proportion of their maſs and velocity; that is, if a ball of two pounds weight with one degree of velocity, and a ball of one pound with two degrees of velocity, be thrown againſt each other, they will arrive at the ſame time, and recoil to equal heights; therefore, not what happens to bodies in an unequal, but in equal times is to be conſidered; and hence aroſe the miſtake. Therefore the new method of computing the force of bodies, is true in one ſenſe and falſe in another; therefore it ſerves only to perplex and embarraſs a ſimple idea; therefore the former method ſhould be preferred. What then ſhall we conclude from theſe two methods of inveſtigation? only this, that the effect is always in proportion to the cauſe. Therefore, if any motion be loſt to the univerſe, the force which is the cauſe of it will alſo of conſequence be loſt. Such were Newton's thoughts with regard to moſt queſtions relating to metaphyſics: you may judge between him and Leibnitz.

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* This diſpute was begun between M. *Huygens* and the abbe *Catalan*, about the force of oſcillating bodies, and continued ſome time between theſe two gentlemen; at laſt, another ſubject of a ſimilar kind, engaged the abbe with the famous *Leibnitz*, who is to be conſidered as the firſt author, that plainly declared, in expreſs words, that the force of bodies was as their maſſes multiplied by the ſquare of the velocity.

I ſhall now proceed to his philoſophical diſcoveries.

PART

PART II.

CHAP. I.

FIRST INQUIRY CONCERNING LIGHT, AND HOW IT COMES TO US. ERRORS OF DESCARTE ON THAT SUBJECT.

Singular Definition of the Peripatetics. The Deſire o eſtabliſhing a ſyſtem miſled Deſcartes. *His Syſtem falſe Error in* Spectacle de la Nature. *The motion of Ligh demonſtrated by* Romer. *The Experiments of* Romer *conteſted and oppoſed in vain. The diſcoveries of* Romer *proved by the Diſcoveries of* Bradley. *Hiſtory o theſe Diſcoveries. Explanation and Concluſion.*

THE Greeks, and after them all the barbarou people, who learnt of them at once to reaſon and to err, have ſaid from age to age, " Light is an accident, which accident is the act of tranſparency, a tranſparent; colours are what move tranſparent bodies. Luminaries and coloured bodies have qualitie ſimilar to thoſe they excite in us, according to the maxim, that nothing can give what it has not. In fine, light and colours are a mixture of the hot, the cold, the dry, and the humid; for the humid, the dry, the cold, and the hot, being the principles of all things, colours muſt conſequently be compoſed of them "

This is the abſurd jargon, which the profeſſors of ignorance, paid by the public, have made human credulity to revere for ſo many ages: this manner of reaſoning prevailed almoſt in all things down to the time of Galileo and Deſcartes. Nay, long after them, the ſame jargon, the diſgrace of human underſtanding, ſubſiſted in many ſchools. I dare aver, that human reaſon ſo obſcured, is far below the moſt bounded knowledge which in brutes we call inſtinct. Hence we canno congratulate ourſelves too much on our good fortune, in being born at a time, and amongſt a people, whe mankind begin to open their eyes, and to enjoy the nobleſt inheritance of humanity, the uſe of reaſon.

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All the pretended philoſophers therefore, having gueſſed of nature at a venture, through the veil under which ſhe lay concealed, Deſcartes at length came, and drew aſide a corner of that great veil. He ſaid, "Light "is a fine and ſubtile matter diffuſed univerſally, and "ſtrikes our eyes. Colours are ſenſations excited in us "by God, according to the motions which tranſmit "that matter to our organs." Thus far Deſcartes was in the right, and ſhould either have ſtopped there, or, in advancing, have taken experiment for his guide: but he was poſſeſſed with the deſire of eſtabliſhing a ſyſtem. That paſſion had the ſame effect on this great man, as paſſions have on all men; they hurry them beyond their principles.

He laid down as the firſt principle of his philoſophy, that nothing ſhould be believed without evidence; and yet, in contempt of his own rule, he imagines three elements formed of pretended cubes, which he ſuppoſes to have been formed by the creator, and to have been broken to pieces in turning upon themſelves, after they came out of the hands of God.

Of theſe ſuppoſititious broken cubes, abraded equally on every ſide, and at laſt rounded into globules, he is pleaſed to make light, which, without any proof, he diffuſes through the univerſe.

The more ingeniouſly this ſyſtem was imagined, the more the reader will perceive it unworthy a philoſopher. For, as nothing of all this is proved, it would be full as reaſonable to admit the cold and hot, the dry and the humid. Error for error, what does it ſignify which is preferred?

According to Deſcartes, the light does not flow to our eyes from the ſun; but is a globulous matter diffuſed univerſally, which the ſun impels, and which preſſes upon our eyes as a ſtaff, puſhed at one end, preſſes the ſame inſtant at the other. Deſcartes was ſo fully convinced of this ſyſtem, that, in his ſeventeenth letter of the third tome, he ſays, and poſitively repeats it: *I confeſs that I know nothing of philoſophy, if the light of the ſun is not tranſmitted to our eyes inſtantaneouſly*. In effect we muſt own, that, as great a genius as he was, he knew very little of true philoſophy; and wanted the experiments of the ſucceeding age. That age is as much ſuperior to Deſcartes, as Deſcartes was to antiquity.

I.

If light were a fluid always diffuſed, and always exiſting in the air, we ſhould ſee as clearly in the night as in the day; becauſe the ſun below the hemiſphere would continually impel the globules on all ſides, and the impreſſion equally affect our eyes; light would circulate like ſound, we ſhould ſee an object beyond a mountain; in ſhort, we ſhould never have a finer day than in a central eclipſe of the ſun; for the moon, at leaſt according to Deſcartes, in paſſing between us and that luminary, would preſs the globules of light, and thus increaſe their action.

II.

The rays refracted by a priſm and forced into a different direction, demonſtrate that light has a real motion, and is not an aſſemblage of globules only compreſſed. Light, on entering a priſm, takes three different ways; its three tracks, in the air, in the priſm, and on its quitting the priſm, are different; nay, its motion is accelerated within the priſm. Is it not then ſomething ſtrange to ſay, that a body which viſibly changes place three times, and quickens its motion, does not move? yet a work is publiſhed, in which it is aſſerted that the progreſſion of light is an abſurdity.

III.

Were light an aſſemblage of globules, a fluid exiſting in the air and every place, the ſmall hole in a *camera obſcura* would fill the whole of it with light; for light being then, on every ſide, preſſed into this ſmall hole, would act on every ſide, as ivory balls diſpoſed into a ſquare or circle, would all be ſcattered if only one of them was ſtrongly preſſed; but the very reverſe appears; the light received through a ſmall aperture, which admits only a ſlender cone of rays, ſcarce illuminates half a foot of the place on which it ſtrikes.

IV. Light,

IV.

Light, coming from the ſun to us, is known to traverſe this immenſe ſpace in about eight minutes, which a cannon-ball, in its utmoſt ſwiftneſs, could not perform in twenty-five years.

The author of *Spectacle de la Nature*, a work of great merit, has fallen into a ſmall miſtake, which may miſlead beginners for whom this book is calculated. He ſays, that light, according to Newton, *is ſeven minutes in coming to us from the ſtars*; he has miſtaken the ſtars for the ſun. Light is ſix months in coming to us from the neareſt fixed ſtar, according to a certain calculation, founded upon experiments very delicate, and, at the ſame time, verv imperfect. It was not Newton, but Huygens and Hartſoeker, who advanced this ſuppoſition: he ſays alſo, to prove that God created light before the ſun, *that light is diffuſed throughout all nature, and is felt ſenſibly, when impelled by the luminous ſtars*; but it has been demonſtrated to be very long in coming from the fixed ſtars to us: if it comes ſo far, it was not diffuſed before. It is neceſſary to be aware of theſe errors, which are every day repeated in abundance of books, that are only echoes to one another.

The following is the ſubſtance of Romer's ſenſible demonſtration, that light employs ſeven or eight minutes in its paſſage from the ſun to the earth.

From the earth at C, (fig. 1.) a ſatellite of Jupiter is obſerved to be eclipſed regularly once in forty two hours and an half. If the earth were immovable, the obſerver at C, would ſee thirty emerſions of that ſatellite in thirty times two and forty minutes and an half; but, at the end of that time, the earth is come to D, and then the obſerver ſees no longer that emerſion exactly at the end of thirty times forty-two minutes and an half; but muſt add the time which light takes up in paſſing from C to D, which time is evidently conſiderable. But this ſpace C D, is ſtill leſs than the ſpace, G H, in the circle. This circle is the great orbit deſcribed by the earth round the ſun in the centre; light, in coming from the ſatellite of Jupiter, paſſes C D in ten minutes, and G H in fifteen or ſixteen. The ſun is between G and H; the light therefore is ſeven or eight minutes in coming from the ſun.

This noble obſervation was long conteſted, but at length admitted, though prejudice endeavoured to illude even the force of experience itſelf. The utmoſt it proves, ſay its oppoſers, is, that the matter of light exiſts in ſpace, and reaches from the ſun to our eyes, requiring ſeven or eight minutes in tranſmitting to us the impreſſion of the ſun; but ſhould it not have been obſerved, that ſuch an inconſiderate anſwer manifeſtly contradicts every principle of mechaniſm? Deſcartes well knew, and acknowledged, that if the luminous matter was like a long ſtaff, preſſed by the ſun at one end, the impreſſion would be inſtantaneouſly communicated to the other. Therefore ſhould a ſatellite of Jupiter preſs a ſuppoſed luminous matter, conſidered as a connected ſeries of globules, extended to our eyes, inſtead of waiting ſeveral minutes before we perceived the emerſion of this ſatellite, we ſhould ſee it at the very inſtant of the emerſion. If, as their laſt ſubterfuge, they pretend to alledge, that the luminous matter is not to be conſidered as a cloſe rigid body, but a fluid; this is relapſing into that error, ſo ſcandalous in a naturaliſt, which ſuppoſes an ignorance of the action of fluids; for this fluid would act in every direction, and as we have already obſerved, there would be no more night, no more eclipſes; motion in this fluid would be ſtrangely ſlow, and inſtead of ſeven minutes, the light of the ſun would not reach us in ſeveral ages.

Romer's diſcovery, therefore, was an inconteſtable proof of the propagation and progreſſion of light; but ſhould the former inveterate prejudice ſtill oppoſe this truth, let it, at leaſt, ſubmit to Dr. Bradley's more recent diſcoveries, by which it is ſo admirably, ſo deciſively confirmed. Dr. Bradley's experiment is, perhaps, the fineſt improvement made in aſtronomy.

Every body knows, that a hundred and ninety millions of our leagues, which, at the loweſt computation, our earth travels in one year, are but a point, when compared to the diſtance between the fixed ſtars and the

earth.

rth. The eye cannot diſcern, whether, at the end of e diameter of this immenſe orbit, a ſtar has changed s poſition relatively to us ; though it is very certain, at, at the end of ſix months, there is between us and ſtar ſituated near the pole, a difference of near ſixty-x millions of leagues ; and this ſpace, which a cannon ll, in its greateſt velocity, could not traverſe in fifty ears, is loſt in the prodigious diſtance between our lobe and the neareſt ſtar ; for the viſual angle, when educed to a certain ſmallneſs, is no longer meaſurable ; becomes nothing.

To find the ſecret of meaſuring this angle, to know s difference when the earth is in *Cancer*, and when in *apricorn*, and thus to find what is called the parallax f the earth, was thought a problem not leſs abſtruſe d difficult than that of the longitude. This arduous roblem, Dr. *Hooke*, ſo well known by his micograhia, attempted to ſolve: he was ſucceeded by the ſtronomer Flamſtead, who had laid down the places f three thouſand ſtars; afterwards M. Molineux, aſſted by that celebrated mechanic Mr. Graham, inventd a machine for facilitating the operation, ſparing neier time, application nor expence ; but at length, Dr. radley put the finiſhing hand to this great work. The achine made uſe of, was called a parallactic teleſcope, d a deſcription of it may be ſeen in Dr. Smith's excelnt ſyſtem of optics. A long teleſcope was ſuſpended erpendicular to the horizon, and in a diſpoſition that e axis of viſion could be eaſily directed to the plane f the meridian, either a little more to the northward to the ſouthward, and by means of a wheel and an dex it could be accurately known how far northward ſouthward the inſtrument had been carried. With is teleſcope ſeveral ſtars were obſerved, and, among thers, a ſtar of Draco was followed by it during a hole year.

What ſhould have been the reſult of this aſſiduous veſtigation ? Certainly if, from the beginning of ſumer to the beginning of winter, the earth had changed s place, if it had travelled ſixty-ſix millions of leagues, e ray of light which had been projected along this teleſcope's leſcope's axis of viſion, muſt have deflected from it! that a new motion was to be given to this tube for receiving this ray, and the wheel and the index ſhewed what quantity of motion had been given to it, and, by an infallible conſequence, how far more northward or ſouthward the ſtar then appears than it did ſix months before.

Theſe admirable operations were began on the third of December, 1725, the time of the earth's approach to the winter ſolſtice; it was thought probable that ſhould the ſtar give any ſign of aberration too ſoon, as in the month of December, it would appear to throw its light farther towards the north, as the earth was near the winter ſolſtice, then moving ſouthward. But to the great aſtoniſhment of the ingenious perſons concerned, ſo early as the 17th of December, the ſtar obſerved appeared on the meridian to be advanced to the ſouthward, quite contrary to their expectations; and an aſſiduous continuance of thoſe obſervations, produced more than could ever have been expected: they diſcovered the parallax of this fixed ſtar, the annual movement of the earth, and the progreſſion of light.

If the earth revolves round the ſun, and light becomes inſtantaneous, it is evident that the ſtar obſerved muſt ſeem conſtantly to move a little towards the north, when the earth moves towards the oppoſite quarter; but if the light be projected from this ſtar, if a certain time be requiſite for its reaching us, a compariſon muſt be made of this time with the celerity of the earth's motion; calculation is all that remains, and by this the velocity of the light of this ſtar was found to exceed that of the mean motion of the earth ten thouſand two hundred times. It was farther found, by obſervations on other ſtars, that light not only moves with ſuch aſtoniſhing velocity, but that its motion is always uniform, though it flows from fixed ſtars placed at very unequal diſtances. It was found that the light of every ſtar paſſes through the ſpace determined by Romer in the ſame time; that is, about thirty-three millions of leagues in eight minutes. It was found, by meaſuring the annual parallax, that the ſtar obſerved in *Draco* is four hundred thouſand times farther from us than the ſun.

Let me now entreat every attentive reader, animated y truth, to conſider, that if light flows uniformly from e ſun to us in near eight minutes, it comes from that ar in *Draco* in ſix years and ſomething above a month; d if thoſe ſtars, ſix times leſs in magnitude, are ſix mes more remote from us, their beams take up above irty-ſix years and a half in coming to us; and yet the ogreſſion of theſe rays is conſtantly uniform. Now t it be conſidered, whether this uniform progreſſion be conciliable with a ſuppoſed matter every where difſed. Let us aſk ourſelves whether this matter would t a little diſturb this uniform progreſſion of the rays? d laſtly, in reading the chapter of Vortices, let not at enormous diſtance which light paſſes through in ch a number of years be remembered; let it be fairly amined whether an abſolute *plenum* would not obuct its paſſage.

To conclude, let us reflect on the many errors into hich this ſyſtem muſt have led Deſcartes. He did not ke a ſingle experiment; he was wholly directed by ncy; inſtead of examining the world, he ſet about eating one. On the contrary, Newton, Romer, Brady, &c. have been guided entirely by experiments, and de facts the only ſtandard of their opinions.

All theſe truths are now acknowledged: in 1738, en the author firſt publiſhed in France theſe *elements* Newton's philoſophy, they were all oppoſed. Such the reception truth always meets with from thoſe who ve been nurſed in error.

CHAP. II.

SYSTEM OF MALLEBRANCHE EQUALLY ERRONEOUS WITH THAT OF DESCARTES; NATURE OF LIGHT; ITS COURSES; ITS RAPIDITY.

Error of Father Mallebranche. *Definition of the Matter of Light. Fire and Light the ſame. Rapidity of Light. Extreme Minuteneſs of its Particles. Progreſſion of Light. Proof of the Impoſſibility of a Plenum. Obſtinate Oppoſition to theſe Truths. Abuſe of the Holy Scriptures againſt theſe Truths.*

FATHER Mallebranche, who, in examining the errors of the ſenſes, was not exempt from thoſe that flowed from the ſubtilty of his genius, adopted the elements of Deſcartes without proof; but changed many things in that inchanted caſtle; and, though he made as little uſe of experiments as Deſcartes, thought proper to form another ſyſtem.

The vibrations of luminous bodies impreſs, according to him, ſudden ſtrokes upon ſmall and gentle vortices, capable of compreſſion, and entirely compoſed of ſubtile matter. But had Mallebranche been aſked, in what manner theſe ſmall and gentle vortices tranſmitted light to our eyes? how the action of the ſun could paſs in an inſtant through ſo many ſmall bodies compreſſed upon one another, of which a very ſmall number were ſufficient to intercept that action? why theſe gentle vortices did not mingle in turning upon one another? how theſe vortices became elaſtic? in fine, why he ſuppoſed theſe vortices? What would father Mallebranche have replied? Upon what foundation did he build this imaginary edifice? Should men, who talked of nothing but truth, have wrote nothing but romances?

What then at length is light? *It is fire itſelf*, which burns at a ſmall diſtance when its parts are leſs attenuated, or more rapid, or more united; and which gently ly illuminates our eyes, when it acts from a greater diſtance, and its particles are more rare, leſs rapid, and leſs united. Thus a lighted candle would burn the eye at the diſtance of only ſome lines of an inch, and gives its light at that of ſome inches. Thus the rays of the ſun, diffuſed through the ſpace of the air, illuminate objects, and, collected by a burning-glaſs, melt lead and gold *.

If it be aſked what fire is, my anſwer will be, that it is an element which I know only by its effects; and I ſay here, as every where elſe, that man is not made to know the ſecret nature of things; that all he can do is to calculate, meaſure, weigh, and make experiments.

Fire does not lighten nor ſhine always. Fire not diſplayed, whether in an iron bar, or in wood, cannot emit rays from the iron or the wood; conſequently cannot be luminous, nor can be ſo till the ſurface is ignited.

The rays of the full moon impart no ſenſible heat when collected in the focus of a burning-glaſs, though they give a conſiderable light. The reaſon is evident; the degrees of heat are always proportionable to the denſity of the rays. Now it is proved that the ſun, at an equal height, darts ninety thouſand times more rays than the full moon reflects to us in the horizon. Therefore it is neceſſary for the rays of the moon, in the focus of a burning-glaſs, to give a heat equal to that given by the rays of the ſun, in a glaſs of equal dimenſions, that there be ninety thouſand more rays in the focus than there are.

They who conſider light and fire as two ſubſtances are miſtaken, founding their opinion of the fire's not being always luminous, and light not always heating. This is the ſame as making two beings of every ſubſtance that can be applied to two uſes.

Fire is projected in every direction from the radiant point, and hence is perceived on all ſides; ſo that, in the

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* That light is a material ſubſtance, and what we call body, is not to be doubted; becauſe we find in it ſomething that has motion, or is propagated in time; ſomething that acts upon bodies, and produces alterations and changes in their matter and form.

the geometrical phraſe, it may be conſidered as lines drawn from the centre to the circumference. In the ſame manner, every aſſemblage, every collection, every pencil of rays, proceeding from the ſun, or any fire whatever, is to be conſidered as a cone, the baſis of which is in the eye, and the apex at the ſun or fire that projects it.

This matter of fire paſſes from the ſun to us, and even as far as Saturn, with a rapidity that ſtartles the imagination. Calculation teaches us, that if the diſtance of the ſun be 24.000 ſemidiameters of the earth, the light muſt move from that planet to us, at the rate of 1,000,000,000 feet in a ſecond. Now a bullet of a pound weight, diſcharged with half a pound of powder, flies only 600 feet in a ſecond; ſo that the velocity of a ray of light exceeds (in round numbers) that of a cannon ball 1,666,600 times. It is therefore certain, that if a particle of light was only the 1,600,000th part of a pound, it would neceſſarily follow, that the rays of light muſt have the ſame effect with cannon; and were they only a thouſand millions of times ſtill ſmaller, one ſingle moment of emanation of light would deſtroy every thing on the ſurface of the earth. How inconceivably minute then muſt theſe rays be to enter our eyes without the leaſt injury [*]!

The ſun, which projects this luminous matter to us in ſeven or eight minutes, and the ſtars, thoſe other ſuns, which tranſmit it to us in ſeveral years, ſupply it perpetually, without any apparent waſte in themſelves; in the ſame manner as muſk is conſtantly emitting odorous particles, without any ſenſible diminution of its weight.

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[*] Since the weight of bodies is proportioned to the quantity of matter, it follows, that where the latter is diminiſhed indefinitely, the former will be alſo diminiſhed indefinitely: therefore the weight of light muſt be inſenſible in ever ſo great a quantity of it. Boerhaave cauſed a globe of iron, twelve inches in diameter, to be heated red-hot, and ſuſpended at the end of a very accurate balance, and counterpoiſed by weights at the other end very exactly: in this manner it was ſuſpended, till all the particles of heat or light were eſcaped, when he found the equilibrium of the balance not to be in the leaſt affected.

In fine, the rapidity with which the ſun projects his rays, is probably in proportion to his magnitude, which is about a million of times greater than that of the earth; and to the velocity with which this immenſe body of fire turns round its axis in twenty-five days and a half.

We may here conclude, from the velocity with which the ſubſtance of the ſun flies off towards us in a right line, how unnatural the plenum of Deſcartes is; for, 1. How could a right line be projected to us through ſo many millions of ſtrata of matter moving in a curve, and through ſo many different motions? 2. How could ſo tenuous a body in ſeven or eight minutes paſs through a ſpace of 1,320,000,000,000 leagues from a ſtar to us, if in this ſpace it was to paſs through a reſiſting matter? Every ray muſt in a moment diſplace 1,320,000,000,000 of leagues of ſubtile matter.

Let it be further obſerved, that this imaginary ſubtile matter would, in an abſolute plenum, reſiſt equally with the moſt compact matter. Thus a ray projected from a ſtar, muſt make a much greater effort than to paſs through a cone of gold, whoſe axis is 1,000,000,000,000 of leagues.

Experience, that true maſter of philoſophy, farther ſhews us, that light in coming from one element into another, from one medium into another, paſſes through entire, as we ſhall prove; a great part of it is reflected, the air repelling more than it tranſmits, ſo that it would be impoſſible for the light of any of the ſtars to reach us; it would be wholly repelled and abſorbed, before a ſingle ray could penetrate half way to our atmoſphere. Would they not even be abſorbed by other atmoſpheres? But in the chapters where we ſhall explain the principles of gravitation, we ſhall prove, by a ſeries of arguments, that this pretended plenum was a romance.

Let us here ſtop a moment, to obſerve how ſlowly truth eſtabliſhes itſelf amongſt mankind. It is almoſt fifty years ſince Romer demonſtrated by obſervations on the ſatellites of Jupiter, that light is tranſmitted from the ſun to the earth in about ſeven minutes and a half; notwithſtanding which, the contrary is not only main tained in many philoſophical books, but in a collection upon that ſubject, in three volumes, extracted from the obſervations of all the academies in Europe, printed in 1730, page 35, volume I. there is this paſſage: "Some "have pretended, that a luminous body, as the ſun, "emits continually an infinity of ſmall inſenſible parti-"cles, which conduct the light to our eyes; but this "opinion, which has ſome relation to the old philoſo-"phy, cannot be maintained." This opinion may, however, be demonſtrated by more than one method, and ſo far from agreeing with the old philoſophy, that it is directly contrary to it; for, can any thing be more contrary to words void of ſenſe, than meaſures, calculations, and experiments?

Other oppoſers have appeared to attack this truth of the emanation and progreſſion of light, with the ſame weapons which men, of more popularity than erudition, uſed ſo imperiouſly, but in vain; againſt Galileo's opinion of the motion of the earth.

They who arm authority againſt reaſon make uſe of the ſacred writings, which teach us morality, as a guide in philoſophy. La Pluche has actually made Moſes a natural philoſopher; if from ſimplicity he deſerves pity, and ſtill more, if by that vulgar artifice he intends to throw an odium on thoſe who differ from him in ſentiments.

The ignorant ſhould remember, that they who from a like pretence condemned Galileo, have branded their native country with an infamy, which only the name of Galileo can efface. The light of the day, according to them, muſt not proceed from the ſun, becauſe it is ſaid in Geneſis, God created light before the ſun.

But theſe gentlemen ſeem to forget, that in Geneſis it is alſo ſaid, that God divided the light from the darkneſs, and called the light day and the darkneſs night, and of the evening and the morning made a day, &c. and all this before he created the ſun. Thus, according to the reaſoning of theſe naturaliſts, the ſun could not have made the day, nor the abſence of the ſun the night.

They add, that God ſeparated the waters from the waters, and by this ſeparation they underſtand the ſea and the clouds. But, according to them, the vapours, which form the clouds, muſt not have been raiſed by the ſun, as they really are: for, according to Geneſis, the creation of the ſun was poſterior to the ſeparation of the upper and lower waters. Now they own that it is the ſun which raiſes theſe *upper* waters, and thus contradict themſelves. Will they deny the motion of the earth, becauſe Joſhua commanded the ſun to ſtand ſtill? Will they deny the unfolding of ſeed in the earth, becauſe it is ſaid, the grain muſt rot before it ſhoots? They muſt therefore, with all the ſenſible part of mankind, acknowledge, that phyſical truths are not to be ſought for in the ſcriptures, which contain the rules of a good life, but not the knowledge of nature.

CHAP. III.

THR PROPERTY LIGHT HAS OF REFLECTING ITSELF WAS NOT TRULY KNOWN; IT IS NOT RRFLECTED BY THE SOLID PARTS OF BODIES, AS GENERALLY BELIEVED.

Not a ſimple Body. Light not reflected by the ſolid Parts. Deciſive Experiments. How, and in what Senſe, Light is reflected from a vacuum. The Experiment how made. Concluſion drawn from that Experiment. The ſmall Pores, large enough to admit Light. Weak Objections againſt theſe Truths.

HAVING ſeen what light is, whence derived, and how long it is in coming to us, let us proceed to its properties and effects, unknown till our days. The firſt of its effects is, its ſeeming to rebound from the ſolid ſurface of all objects to bring the images of them to our eyes.

All men, all philoſophers, the Deſcartes, the Mallebranches, and ſuch as are moſt remote from vulgar opinion, have equally believed, that the ſolid ſurfaces of bodies are what actually reflect light to us. The more ſmooth and ſolid a ſurface is, the more, they ſay, it cauſes the light to rebound from it; but the larger, and the more direct the pores of the body are, the more the rays of light paſs through its ſubſtance. Thus the mirror, covered at the back with a ſurface of quickſilver, reflects all the rays; while the ſame glaſs, without quickſilver, having direct and large pores in prodigious number, admits great part of the rays to paſs through it. The more large and direct pores a body has, the more tranſparent it is; ſuch is, ſay they, the diamond, and ſuch the water itſelf. Theſe were the ideas generally received, and which none called in queſtion: yet all theſe ideas are entirely falſe; ſo remote often is the reſemblance of truth from the truth itſelf. The philoſophers embraced this error, in the ſame manner as the vulgar are miſtaken, when they imagine the ſun no larger than it appears to the eye. In this conſiſted the error of the philoſophers.

We cannot make the ſurface of any body really even, though the ſurfaces of many ſeem perfectly ſmooth and poliſhed. But why do they appear ſo to us? The ſmootheſt ſuperficies, in reſpect to the particles of which light is compoſed, is no more than a great number of mountains, cavities, and ſpaces. The point of the fineſt needle actually abounds with eminences and aſperities, which the microſcope diſcovers. All the pencils of rays of light, which ſhould fall on thoſe unequal parts, would be reflected in the direction they fell; and, falling unequally, would never be regularly reflected, and therefore we could never ſee ourſelves in a glaſs. Beſides, the glaſs has probably a thouſand times more pores than matter, though every point of the ſurface reflects rays; therefore they are not reflected by the glaſs.

The light, therefore, which ſhews us our image in a mirror, does not proceed from the ſolid parts of the ſuperficies of that glaſs; neither is it the effect of the ſolid parts of the mercury and tin ſpread on the back of the mirror; thoſe parts are not evener or ſmoother than the glaſs itſelf. The ſolid parts of the tin and mercury are incomparably larger than the ſolid conſtituent parts of light; if, therefore, the ſmall particles of light fall upon the groſs parts of the mercury, they will ſpread and ſcatter themſelves on all ſides, like grains of lead falling upon rubbiſh. What unknown power then cauſes light to rebound toward us with ſo much regularity? It appears already, that bodies do not return it in this manner. What ſeemed the moſt known and inconteſtible amongſt mankind, becomes a greater myſtery than the weight of the air was formerly. Let us examine this problem of nature, and our wonder will augment. We cannot contemplate it without ſurpriſe.

Expoſe in a dark chamber the cryſtal A B (fig. 2.) to the rays of the ſun, in ſuch a manner, that the light falling on the ſuperficies B, may make an angle of above forty degrees with the perpendicular. Moſt of the rays then no longer continue in the air; they re-enter the cryſtal the inſtant they quit it; they return, you ſee, by an inſenſible curve.

Certainly it is not the ſolid ſurface of the air that repels them into the glaſs; many of thoſe rays entered the air before, when they fell leſs obliquely; why then ſhould theſe rays paſs no longer, when the obliquity is equal to forty degrees nineteen minutes? Do they find more reſiſtance, more matter in the air at this degree, than in the cryſtal they had penetrated? Are there more ſolid parts in the air at forty degrees and one third, than at 40? The air is almoſt two thouſand four hundred times rarer, lighter, and leſs ſolid than the cryſtal; thoſe rays, therefore, ought to paſs into the air with two thouſand four hundred times more facility than they penetrated the ſubſtance of the cryſtal. Though, notwithſtanding this prodigious appearance of facility, they are repelled; but repelled by a force two thouſand four hundred times greater than that of the air; they are therefore not repelled by the air; the rays are therefore not reflected to our eyes by the ſolid parts of bodies. Light rebounds ſo little from the ſolid parts of bodies, that in reality it rebounds from a vacuum, which merits the utmoſt attention.

You have ſeen, that light falling in an angle of 40 degrees, 19 minutes, upon the cryſtal, rebounds almoſt entirely from the air, at the lower ſurface of the cryſtal. Let the light fall on it, in an angle leſs only by a ſingle minute, ſtill leſs of it will paſs beyond that ſurface into the air.

Newton affirms, that could there a method be found to exhauſt the air from under this cryſtal, the rays would no longer paſs through it; but the whole light would be reflected. I have made the experiment; I cauſed an excellent priſm to be fixed in a copper-plate; this plate I placed on the top of an open receiver of an air-pump, and placed the machine in my dark chamber. The light being admitted on the priſm through a hole, and its fall directed in the requiſite angle, I pumped a long time, and the company perceived, that, in proportion as the air was exhauſted, leſs light paſſed into the receiver, till at laſt ſcarce any at all paſſed.

It was a very entertaining phænomenon, to ſee the whole light reflected by the priſm to the ceiling. This experiment therefore demonſtrates, that, in the preſent caſe, light rebounds from a vacuum; but it is well known that this vacuum can have no action. What conſequence then ſhall we draw from this experiment? two palpable truths: firſt, that the ſurface of ſolids does not repel the light; ſecondly, that there is in ſolid bodies a power unknown which acts on light; and it is this ſecond property which we ſhall examine in its place.

Here then are undoubted proofs, that it is not a ſolid ſuperficies that reflects light to us: we ſhall give another proof of this truth. All opaque bodies reduced to thin laminas, ſuffer rays of a certain order to paſs through their ſubſtance, and reflect other rays; now, if light were reflected by bodies, all the rays, which fell upon theſe laminas, would be reflected by them. In fine, we ſhall ſee that ſo aſtoniſhing a paradox never had a greater variety of proofs. Let us begin then by rendering ourſelves familiar with theſe truths.

I.

This light, which is imagined to be reflected by the ſolid ſurface of bodies, returns, in fact, without having touched that ſurface.

II.

Light is not reflected from the back of a mirror by the ſolid ſurface of the quickſilver, but from the very pores of the mirror and the quickſilver.

III.

It is not neceſſary, as it has hitherto been thought, that the pores of the quickſilver ſhould be very ſmall to reflect light; on the contrary, it is neceſſary that they ſhould be large.

It will be new matter of ſurprize to thoſe who have not ſtudied this philoſophy, to hear it affirmed, that the ſecret of rendering a body opaque, is often to enlarge its pores, and that the method of making it tranſparent, is to diminiſh their capacity. The order of nature ſeems apparently to be entirely changed: what appeared the neceſſary cauſe of opacity, is directly the cauſe of tranſparence; and what ſeemed to render bodies tranſparent, is in reality what makes them opaque. Nothing however is more true, as the moſt common experiment demonſtrates. A piece of dry paper, of which the pores are very large, is opaque; no ray of light paſſing through it: reduce thoſe pores, by making it imbibe water or oil, it becomes tranſparent; the ſame thing will alſo happen to Linen, ſalt, &c.

It is proper to acquaint the public, that a perſon, who has lately written againſt theſe truths, with more ſuperciliouſneſs and contempt than knowledge, has attempted to ſneer Newton on theſe diſcoveries. *If*, ſays he, *the ſecret of making a body tranſparent, conſiſts in contracting its pores, our windows muſt be ſmaller, if we deſire more light in our rooms.* I anſwer, that when we pretend to talk like philoſophers, it is highly indecent to affect the buffoon; and that to endeavour to ridicule Newton, is too daring an attempt. Eſpecially, as this very aukward Buffoon ought to have reflected, that large apertures cloſed up, would admit no light; and that a thin atenuous body, pierced with an infinite number of ſmall holes, and expoſed to the ſun, admit a great deal of light: oiled paper, and wet linen, for inſtance, are thin bodies, having their pores contracted by oil or water; and through theſe pores, now rendered more direct, the light paſſes; but would not paſs through the largeſt holes, which traverſing each other, intercept the rays. We ſhould be ſure of being in the right, before we attempt raillery.

The falſe reaſonings, and the jejune railleries, vented in France, againſt Newton's wonderful diſcoveries, would be a ſcandal to the nation, were not the authors of ſuch traſh the diſgrace of philoſophy.

But to return to our ſubject. There are then unknown powers which perform theſe wonders, cauſing the light to rebound before it has touched a ſurface, which repel it before it has touched the pores of a tranſparent ſubſtance, and bring it back even from the centre of a vacuum. Theſe facts, from whatever cauſe they proceed, we are abſolutely obliged to admit.

CHAP. IV.

OF MIRRORS AND TELESCOPES: REASONS GIVEN BY MATHEMATICIANS FOR THE MYSTERIES OF VISION; THESE REASONS NOT FULLY SUFFICIENT.

Plane Mirror. Convex Mirror. ConcaveMirror. Geometrical Explanations of Viſion No immediate Relation between the Rules of Optics and our Senſations. Proved by an Example.

THE rays, which a power, till our days unknown, reflects to the eye from above the ſurface of a mirror, without touching the ſurface, and from the pores of the glaſs, without touching its ſolid parts; theſe rays, I ſay, return to the eye in the ſame manner as they arrived at the mirror. If you ſee your face in it, the rays from your face, falling parallel, and in a perpendicular direction upon the mirror, return thither in the ſame manner as a ball rebounds perpendicularly from the floor.

If in the mirror M. (fig. 3.) we view an object on one ſide of us, as A, the rays from that object act in the ſame manner as a ball, which would rebound to B, the place of your eye. This is called the angle of incidence, equal to the angle of reflection. The line A C is the line of incidence, the line C B is the line of reflection. It is ſufficiently plain, and the bare mentioning demonſtrates, that thoſe lines form equal angles upon the ſurface of the glaſs; why then do I not ſee the object, either in A, where it is, or in C, whence the rays flow to the eye, but in D, behind the ſame mirror?

Geometry will tell us, it is becauſe the angle of incidence is equal to the angle of reflection; becauſe the eye in B (fig. 4.) carries the object to D; becauſe objects can act upon you only in right lines, and becauſe the right line from your eye B, continued behind the glaſs to D, is as long as the line A C, added to the line C B.

If we alſo tell you, that you never ſee objects but from the point where the rays begin to diverge, ſuppoſe the mirror M I, the pencils of the rays, from every point of the object A, begin to diverge the inſtant they quit the object, they proceed to the ſurface of the glaſs, there each of thoſe rays falls, diſperſes, and is reflected towards the eye. The eye carries them back to the points D D, at the end of the right lines, where the ſame rays would meet; but in meeting at the points D D, thoſe rays act in the ſame manner, as at the points A A, where they begin to diverge; therefore you ſee the object A A, at the points D D.

Theſe angles and lines ſerve doubtleſs to make us underſtand this artifice of nature; but they are far from informing us of the phyſical efficient reaſon, why the ſoul, without any heſitation, carries the object to an equal diſtance, beyond the mirror, as it is on this ſide of it. Theſe lines repreſent what really happens; but do not ſhew why it happens.

If you would know in what manner a convex mirror diminiſhes, and a concave mirror enlarges objects, theſe lines of incidence and reflection will give you the ſame reaſon.

We are told, that the cone of rays, which diverges from the points A (fig. 5.) and falls on the convex mirror, makes angles of incidence upon it, equal to the angles of reflection, of which the lines flow to the eye. Now theſe angles are leſs, than if they had fallen on a plane ſurface; therefore if they are ſuppoſed to paſs to B, they will converge there much ſooner, and the object in B B be ſmaller. Now the eye carries the object to B B, the points where the rays begin to diverge; therefore the object muſt appear leſs, as it does in the figure. For the ſame reaſon that it appears leſs, it appears nearer, as the extreme points of the rays from B B, are actually nearer the mirror, than thoſe of the rays from A A.

For a contrary reaſon, you muſt ſee objects greater and more remote, in a cancave mirror, when placed near enough to the mirror. For the cones of the Rays from A A, (fig. 6.) diverging upon the mirror at the points where thoſe rays fall, if they were reflected through that glaſs, they would unite only in B B; therefore they are ſeen in B B. Now B B is greater and farther remote from the mirror, than A A, therefore you ſee the object greater, and at a greater diſtance.

This is in general what happens in the reflection of rays to our eyes, and this ſole principle, that the angle of incidence is always equal to the angle of reflection, is the true foundation of all the myſteries of catoptrics.

We are now to know in what manner lenſes augment objects, and leſſen diſtances; and laſtly why objects, that are painted reverſely in our eyes, ſhould however be ſeen as they really are.

In regard to magnitudes and diſtances, the mathematics demonſtrate that the greater the angle made by an object in the eye, the greater the object will appear: nothing is plainer. The line H K at an hundred paces forms an angle, as you ſee in the eye A (fig 7); at two hundred paces, it forms another leſs by one half in another eye as B (fig. 8.) Now the angle formed on the retina, or of which the retina is the baſe, is as the angle of which the object is the baſe. Theſe angles are oppoſite at their ſummits; therefore, according to the firſt notions of the elements of geometry, they are equal. Hence if the angle formed in the eye A, be double the angle formed in the eye B, the object will appear as large again to the eye A, as to the eye B.

Now that the object may be ſeen as large by the eye at B, as by the eye at A, it is neceſſary that the eye B, receive as large an angle as the eye A, which is as near again to it. The lenſes of a Teleſcope produce this effect. For the greater facility let us ſuppoſe here only one lens, and without conſidering the effects of many lenſes. The object H K, (fig. 9) tranſmits its rays to this lens, which are united at ſome diſtance from it. Let us conceive a lens ſo contrived, that thoſe rays croſs one another in ſuch a manner, as to form in the eye C, as great an angle as that in the eye A. The eye then, you will ſay, judges by that angle. It ſees the object of the ſame magnitude as the eye in A. But in A it ſees it at the diſtance of an hundred paces: therefore in C, receiving the ſame angle, it will ſtill ſee it at the ſame diſtance. The whole effect of combined lenſes, different teleſcopes, and microſcopes, which magnify objects, conſiſts therefore in bringing objects to the eye in a greater angle. The object A B, (fig. 10) is ſeen by the means of a lens in the angle D C D, which is much greater than the angle A C B.

You aſk again from the rules of optics, why objects, which are painted reverſe upon our retina, are ſeen in their true ſituation? The ray from the head of the man A, (fig. 11) falls upon the lower point of the retina A; his feet B, are carried by the rays B B, to the upper part of the retina B.

Thus the man is really painted with his head downwards and his feet upwards at the bottom of our eyes. Why therefore do we not ſee this man reverſed, but upright and as he is?

To reſolve this queſtion, the compariſon of a blind man is uſed who holds in his hands two ſticks croſſing each other, with which he gueſſes very rightly of the poſition of objects. For the point of the left, being felt by the right hand with the help of the ſtick, he judges it immediately on the left; and the point, which communicates with his left hand by the means of the other ſtick, he judges on the right, without miſtake. All the maſters of optics tell us therefore, that the lower part of the eye, immediately transfers its ſenſations of the object to the ſuperior part, and that the upper part of the retina, as naturally tranſmits its ſenſation to the inferior part; conſequently the object is ſeen in its true ſituation.

When we perfectly know all the angles and mathematical lines, by which the paſſage of light is traced to the bottom of the eye, we are not however to believe that we know in what manner our perceptions of the magnitudes, diſtances, and ſituations of things are attained. The geometrical proportions of thoſe angles and lines are indeed juſt; but there is no more relation between them and our ſenſations, than between the ſound we hear, and the magnitude, diſtance and ſituation of the ſonorous body. My ear is ſtruck by the ſound; I hear the tones and nothing more. My eye is agitated by ſight; I ſee colours and nothing more. The proportion of thoſe angles and lines cannot be in any reſpect the immediate cauſe of the judgment I form of objects, nay in many caſes, thoſe proportions are not in the leaſt agreeable to the manner in which I ſee objects. For inſtance, a man is ſeen of the ſame ſize at four and at eight paces from us. Tho' the image of that man at four paces is exactly twice as large in the eye as at eight. The angles are different; but the object appears of the ſame dimenſions: it is therefore evident from this ſingle example, that theſe angles and lines are far from being the immediate cauſe of the manner in which we ſee objects.

Before therefore I continue the inquiries with regard to light, and the mechanic laws of nature, it is your command that I ſhould here ſhew in what manner the ideas of diſtances, magnitudes, ſituations, and objects, are communicated to the ſoul. This inquiry will furniſh ſeveral new truths, the only excuſe for writing a book.

CHAP. V.

IN WHAT MANNER WE KNOW DISTANCES, MAGNITUDES, FIGURES, AND SITUATIONS.

The optical angles and lines, not ſufficient for knowing diſtances. Proved by an example. Magnitudes of figures not known from thoſe optic lines. Proved by an example. Experimental proof on a perſon born blind, by Mr. Cheſelden. In what manner we know diſtances and magnitudes. Example. We learn to ſee as we learn to read. Extenſion not known from the ſight.

LET us begin with diſtance: it is plain that it cannot of itſelf be immediately perceived, for diſtance is no more than a line extended from an object to us. This line terminates in a point, we therefore perceive only this point; and whether the object be a thouſand miles or only a foot from us, the point is ſtill the ſame. We have not therefore any immediate means of knowing diſtance inſtantly, as we have by the touch of diſtinguiſhing whether a body be hard or ſoft; by the taſte, whether it be ſweet or bitter; or by the ear, whether of two ſounds the one be grave and the other acute. The idea of diſtance therefore muſt be attained by means of ſome other intermediate idea; but I muſt at leaſt have that intermediate idea at the ſame time, for an idea that I have not can certainly never occaſion my having another. I ſay ſuch a houſe is a mile from ſuch a river; but if I do not know where that river is ſituated, I certainly do not know where the houſe is ſituated. A body that eaſily receives an impreſſion from my hand, I immediately conclude to be ſoft: another reſiſts; I immediately perceive its hardneſs. It is therefore neceſſary, that I perceive the angles formed in my eye, in order to determine immediately the diſtances of objects. But the greateſt part of mankind do not ſo much as know that there are any ſuch angles exiſting: conſequently theſe angles cannot be the immediate cauſe of our knowing diſtances.

The perſon who, for the firſt time of his life, hearts the report of a cannon, or the harmony of a conſort, would not be able to judge whether that cannon were diſcharged, or that concert performed, at the diſtance of a league or of thirty paces. Experience only can accuſtom him to judge of the diſtance, and the place whence thoſe ſounds proceed. The vibrations, the undulations of the air, convey ſound to his ear, or rather to his ſoul: but they apprize his ſoul no more of the place where the noiſe commenced, than they inſtruct him in the form of a cannon, or of the inſtruments of muſic. It is exactly the ſame with regard to the rays of light trrnſmitted from an object, they do not at all inform us of the diſtance of that object.

Nor do they afford us any more intimation with regard to magnitudes, and even forms or figures. I behold at a great diſtance a kind of ſmall round tower. I advance, I perceive, and at laſt touch a large quadrangular edifice. Certainly what I ſee and touch, is not what I ſaw before. The little round object I had in my eye, is not this large ſquare edifice. The object meaſurable and tangible therefore is one thing, and the object of viſion is another. I hear in my chamber the noiſe of a coach: I open my window and ſee it; I go down and get into it. Now this coach, which I have heard, this coach which I have ſeen, and this coach which I have touched, are abſolutely three different objects of my ſenſes, which have no immediate relation to one another.

But as I have before obſerved, it is demonſtrated, that an angle is formed in my eye twice as large when I ſee a man at four feet diſtance, as when I ſee the ſame man at eight. Tho' that man ſtill appears of the ſame ſize. Why ſhould my perception thus contradict the mechaniſm of my organs? The object is really as ſmall again in my eyes, and I ſee it twice as large as it is. It would be in vain to attempt the explanation of this myſtery by the paſſage through the chryſtalline, or the form that humour takes in our eyes. Whatever ſuppoſition we may make, the angle in which I ſee a man at four feet from me, is always twice as large as the angle in which I ſee him at eight: geometry therefore can never ſolve this problem; in philoſophy it is equally impoſſible;

for if you ſuppoſe that the eye has a new conformation, in which the chriſtalline humour is enlarged, and the angle augmented; ſtill it will have the ſame effect upon an object, when at eight or four feet diſtance. The proportion is ſtill the ſame, notwithſtanding you ſee the object at eight feet under half the angle equally large, as at four feet, when the angle is of twice the dimenſions. It is therefore equally impoſſibly either by geometry or philoſophy, to remove the difficulty.

Theſe geometrical lines and angles are no more the cauſe why we ſee objects in their places, than that we ſee them in ſuch magnitudes, and at ſuch diſtances. The ſoul does not conſider whether ſuch a part is to paint itſelf at the bottom of the eye, it has no concern with lines it does not behold. The eye turns on itſelf downwards to ſee what is near the earth, and upwards to look at what is above it. This could only be explain'd and rendered inconteſtible by a perſon born blind, and reſtored to the ſenſe of ſight. For if this blind perſon, at the moment he received his ſight, had judged of diſtances, magnitudes, and ſituations; it would have followed that the optic angles, formed that inſtant on his retina, had been the immediate cauſes of his thoughts. Dr. Barclay accordingly has aſſured us, after Mr. Locke (and indeed has gone beyond Mr. Locke in this particular) that neither ſituation, magnitude, diſtance, nor figure, would be at all diſcerned by a blind perſon, at the inſtant his eyes ſhould behold the light.

But where was the blind perſon to be found, on whom the indiſputable deciſion of this queſtion depended? In the year 1729, Mr. Cheſelden, one of thoſe famous ſurgeons who unite a great extent of knowledge with dexterity in operations, having imagined, that ſight might be given to a perſon born blind, by removing the cataract, which he conceived to have been formed in his eyes almoſt at the moment of his birth, he propoſed the operation. The blind perſon made difficulties to conſent to it. He could not very well conceive, that the ſenſe of ſight could contribute ſo greatly to his happineſs. Had they not explained to him it's uſe in learning to read and write, he had never deſired to ſee. His indifference with regard to ſight ſufficiently proves, that *It is impoſſible to be unhappy from the privation of valuable things, of which we have no idea*; a truth of the laſt importance. The operation was however performed and fully ſucceeded. The youth, then about fourteen years of age, ſaw the light for the firſt time. This experiment confirmed all that Locke and Barclay had juſtly foreſeen. For a long time he diſtinguiſhed neither magnitude, diſtance, ſituation, nor even figure. An object of an inch magnitude being placed before his eyes, and concealed an houſe from his ſight, appeared to him as large as the houſe. Every thing he ſaw, ſeemed at firſt to be upon his eyes, and to touch them, as the object of the ſenſe of feeling are in contact with the ſkin. He could not diſtinguiſh what he had judged round by the help of his hands, from what he had judged angular; nor diſcern with his eyes, whether what his hands had perceived to be above or below. He was ſo far from knowing magnitudes, that having at length conceived by ſight, that the houſe was larger than his chamber, he could not conceive how ſight could give him that idea. It was not till after two months experience, that he perceived pictures to be only repreſentations of ſolid bodies. And when after ſo long a trial of his new ſenſe, he thought, that bodies, and not ſurfaces only, were in the painted tablets, he applied his hand to them, and was amazed that he did not feel thoſe ſolid bodies, of which he began to perceive the repreſentations. He aſked which deceived him; the ſenſe of feeling or the ſenſe of ſight.

This was an indiſputable deciſion, that the manner in which we ſee objects, is no immediate conſequence of the angles formed in our eyes; for the ſame mathematical angles were formed in the eyes of this youth, as in ours; and were of no manner of uſe to him without the aid of experience, and the other ſenſes.

How then do we repreſent to ourſelves magnitudes and diſtances? In the ſame manner as we imagine the paſſions of men, by the colours thoſe paſſions paint in their faces, and the alteration they make in their features. very perſon can diſcover grief in the countenance of another by its colour. It is the ocular language of nature; but a language to be learned only by experienec: and it is from experience only we learn, that when an object is too remote, we ſee it in a confuſed and faint manner: thence we form ideas, which always accompany the ſenſe of ſight. Thus every man, who, at the diſtance of ten paces, has ſeen a horſe five feet high if he ſees, a few minutes after, the ſame horſe no bigger than a ſheep, his mind, by an involuntary judgment immediately concludes that the horſe is at a great diſtance.

It is very certain, that when my horſe appears no larger than a ſheep, there is formed in my eye a very ſmall picture, a very acute angle; but this is only what attends, not what occaſions, my thought.

In like manner my brain is differently affected when I ſee a man red with ſhame, and red with anger; but thoſe impreſſions would ſuggeſt nothing to me of the paſſions that agitate the ſoul of that man, without the language of experience, which alone imparts to me that knowledge.

The angle is ſo far from being the immediate cauſe of my judging a horſe to be at a great diſtance, when he appears very little, that, on the contrary, I ſee the ſame horſe of equal dimenſions, when at ten, twenty, and thirty paces from me, though the angle is double. triple, and quadruple at thoſe different diſtances.

I ſee at a great diſtance, through a little hole, a man upon the top of a houſe; the diſtance and ſmall number of rays prevent me from diſtinguiſhing at firſt whether it be a man or not: the object ſeems very ſmall and I take it for a ſtatue of two feet at moſt: the object moves; I conclude it a man, and from that inſtant imagine him to be of the uſual ſtature. From whence proceed two judgments ſo different? When I am perſuaded that I view a ſtatue, I imagine it two feet high, becauſe I ſee it under ſuch an angle: experience does not then induce my thoughts to contradict the rays impreſſed upon my retina; but as ſoon as I was convinced it was a man, the connection implanted by experience in my brain, between the idea of a man and the idea of an height from five to ſix feet, obliges me, without thinking of it, to imagine, by an inſtantaneous impulſe, that I ſee a man of ſuch a height, and, in effect, to ſee that height.

Hence we muſt abſolutely conclude, that diſtances, magnitudes, and ſituations, are not, properly ſpeaking, things to be ſeen; that is, the proper and immediate objects of ſight. The proper and immediate object of ſight is nothing more than coloured light; all the reſt we attain by time and experience. We learn to ſee, exactly as we learn to ſpeak and read. The difference is, that the art of ſeeing is the moſt eaſy, and that we are all equally the pupils of nature.

The ſudden and almoſt uniform judgments, which every mind forms at a certain age of diſtances, magnitudes, and ſituations, induces us to think nothing more is neceſſary than to open the eyes, in order to ſee things as they really are. But this is a miſtake; the aſſiſtance of the other ſenſes is neceſſary. If men had no other ſenſe than that of ſight, they would have no means of knowing the extent of length, breadth, and depth; and a pure ſpirit could never know it, unleſs God revealed it to him. It is very difficult to ſeparate in our underſtanding the extenſion of an object from its colours. Every thing we ſee is extended; and thence are all led into the belief, that we actually ſee extent. We can ſcarce diſtinguiſh in thought the yellow we ſee in a piece of gold, from the piece of gold of which we ſee only the yellow. Thus when we hear the word *guinea* pronounced, we cannot help annexing the idea of that coin to the ſound we hear pronounced.

If all men ſpoke the ſame language, we ſhould believe, that there would be a neceſſary connexion between words and ideas. Now all men have the ſame language with regard to the imagination. Nature ſays to all, when you have ſeen colours for a certain time, your imagination will repreſent to you, in the ſame manner, all the bodies in which thoſe colours ſeem to reſide. The ſudden and involuntary judgment you form, ſhall be uſeful to you during the courſe of your lives:

for if, to judge of the diſtances, magnitudes, and ſituations of all that ſurround you, it were neceſſary to wait till you had examined the angles and rays of viſion, you would die before you knew, whether the things you had occaſion to uſe were ten paces diſtant or an hundred million of leagues; whether they were of the bigneſs of a mite or a mountain. In ſuch confuſion it would be better for you to be born blind.

It is therefore very wrong to ſay, we are deceived by our ſenſes. Each of the ſenſes truly diſcharge the function deſigned them by nature. They mutually aſſiſt each other in conveying to the ſoul, by the aſſiſtance of experience, ſuch a meaſure of knowledge as is conconſiſtent with our condition. We demand of our ſenſes, what they were not formed to beſtow. We are for knowing from our ſight, ſolidity, magnitude, diſtance, &c. but the touch muſt here be united with the ſight, and experience with both. If father Mallebranche had conſidered nature in this view, he had aſcribed fewer errors to our ſenſes, which are the only ſources of all our ideas.

We muſt not, however, extend this ſpecies of metaphyſics to all caſes. It muſt never be uſed till mathematical reaſonings are inſufficient: this is alſo an error, into which father Mallebranche muſt be allowed to have fallen. For inſtance, effects, accounted for by the rules of optics alone, he attributes wholly to the imagination, He believes that it is owing entirely to the imagination that the ſun and moon appear larger in the horizon than in the meridian. This phænomenon, which for above a century hath employed ſo many philoſophers, we ſhall endeavour to explain in the following chapter.

CHAP.

CHAP. VI.

Why the Sun and Moon appear larger in the Horizon than in the Meridian.

WALLIS was the firſt who thought, that the long interpoſition of land, and even of the clouds, cauſed the ſun and moon to appear larger in the horizon than in the meridian. This opinion Mallebranche confirmed, with all the proofs the ſagacity of his admirable genius could furniſh, and Regis maintained a celebrated diſpute with regard to the cauſe of this phænomenon, which he attributed to a refraction in the vapours of the earth. He was, however, miſtaken; the effect of theſe refractions being preciſely the very reverſe of what Regis attributed to them. Father Mallebranche likewiſe was equally wrong in maintaining, that the imagination, ſtruck with the vaſt extent of countries and clouds between the horizon, repreſented to itſelf that planet much larger at the extremity of thoſe countries and clouds, than when, having reached the meridian, it is beheld without an interpoſition of objects.

The moſt ſimple experiments demoliſh Mallebranche's ſyſtem. Some years ago I had the curioſity to begin a formal examination of this phænomenon; and accordingly procured ſeveral paſte-board tubes, between ſeven and eight feet in length, and half a foot in diameter. I alſo procured ſome children, whoſe imagination was little uſed to judge of this luminary by the apparent extent of land between the planet and the eye. Theſe children viewed the ſun in the horizon, without even ſeeing the land or clouds, the tubes giving only a ſight of the ſun; and they all declared it much larger than at noon. This experiment, with ſeveral others, induced me to ſeek ſome other cauſe; and it was already my misfortune to form a ſyſtem, when happily Dr. Smith's mathematical ſolution of the problem fell into my hands and ſaved me the errors of an hypotheſis. The following is the explanation, which well deſerves to be conſidered.

We muſt remember, that according to the rules of optics, the concavity of the heavens appears to be an elliptical vault of which the following is a familiar proof Our ſight diſtinctly extends itſelf to the point, where, according to Dr. Hooke's obſervations, objects form in the eye an angle of the eight thouſand part of an inch at leaſt. The man O P (fig. 12) five feet in height, views the object A B, alſo five feet high, and 25,000 feet diſtant. He ſees him under the angle A O B. But this angle A O B not being in the eye equal the eight thouſandth part of the inch, is hardly viſible. But if he looks at the object C, the angle is ſtill ſmaller. He ſees it as if the object was in A D. Thus all objects beyond C become ſtill leſs diſtinct; the houſes and clouds at all diſtances beyond C muſt appear at the horizon towards C; all the clouds, therefore, at the diſtance of 25,000 feet, appear to our eye in the horizon, and ſink gradually. Conſequently all the clouds, which riſe at G, (fig. 13) about three quarters of a league in height, muſt appear to us as in our horizon. Thus inſtead of ſeeing the clouds G G, as high as the cloud N, they will appear to touch the earth, and the cloud N, over our heads about three quarters of a league diſtant. So that we are not to conſider the heavens as a cieling, or circular cincture, but as an eliptical vault, of which the greateſt diameter, B B, is about ſix times larger than the the ſmaller A D. We therefore ſee the ſky in the form B A B, and when the ſun or moon appears at B, in the horizon, they ſeem to us at D, about a third more diſtant than when thoſe planets are in A. Now we muſt ſee them under the angles B and A. It therefore remains to examine theſe angles. It would at firſt be thought, that they ſhould be ſmaller, when the object is more remote; and larger, when nearer. But here it is juſt the contrary. The real path of an object is B D R E, (fig. 14) but the apparent path B A C G. Now the angles are formed by the apparent object; therefore in drawing lines from the eye at P, to the real places of the object D, the lines will neceſſarily include the apparent object. For inſtance, you ſee the angle formed by the object in the horizon at E is conſiderably large; and that at C it becomes greatly contracted; the difference is ſtill greater at the meridian. The diſk of the luminary in the meridian is three, and on the horizon nearly nine; for the diameters are as the apparent diſtances: now the apparent diſtance of the planet is about nine on the horizon and three in the meridian: ſuch alſo is its apparent magnitude.

This truth is confirmed by a ſimilar experiment. Obſerve two ſtars, the real diſtance between which is the tenth of a degree. They appear much farther remote from one another on the horizon, than in the meridian. Theſe two ſtars, always equidiſtant, are ſeen on the horizon under the angle C F D, (fig. 15) which is much larger than the angle A F B, in the meridian. You ſee that this apparent difference flows exactly from the ſame cauſe as that given above.

From the above rule and the obſervations that confirm it, the following are the proportions of the ſun and moon's apparent diameters or diſtances.

At the horizon the apparent diameters of the ſun and moon is — —	100
At 15 degrees altitude — —	68
At 30 degrees — —	50
At 90 degrees — —	30

In like manner if any two ſtars, always equidiſtant, appear on the horizon at the diſtance of 100 from each other; in the meridian they will appear at 30, which is nearly in proportion of nine to three.

This theory is farther confirmed by another obſervation. The moon at ſome ſeaſons of the year appears conſiderably larger than at other times. The ſun alſo appears larger in winter than in ſummer; and the differences in this apparent magnitude being more ſenſible at the horizon than in the meridian, are the more eaſily obſerved. The reaſon of this increment of magnitude is, that when the diameter of the moon or ſun appears larger, thoſe bodies are in reality nearer us. The ſun is about 1,200,000 leagues nearer the earth in winter than in ſummer; therefore in winter it appears larger. But this largeneſs of its diſk is ſomewhat diminiſhed by the denſity of the atmoſphere.

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The moon is in ſummer in her perageum; and therefore her diameter appears larger. Beſides, the magnitude of her diſk on the horizon is leſs diminiſhed in ſummer than in winter; becauſe the air in ſummer is more rarified and more ſubtile.

This phænomenon therefore entirely belongs to geometry and optics; and it is Dr. Smith's glory to have ſolved a problem, for which the greateſt geniuſes had formed ineffectual hypotheſes.

CHAP. VII.

OF THE CAUSE WHICH REFRACTS THE RAYS OF LIGHT IN PASSING FROM ONE MEDIUM TO ANOTHER. CAUSE OF THAT GENERAL LAW OF NATURE UNKNOWN BEFORE NEWTON. INFLEXION OF LIGHT, ALSO AN EFFECT OF THE SAME CAUSE.

What refraction is. Proportion of refractions found by Snellius. Which is as the ſine of refractions. Grand diſcovery of Newton. Light refracted before it enters the body. Examination of attraction. The word attraction ſhould be examined before it is rejected. Impulſion and attraction equally certain and unknown. Why attraction is an occult quality. Proofs if attraction. Inflexion of light near the attracting bodies.

WE have already ſeen the almoſt incomprehenſible manner in which the reflection of light is performed, and which impulſion cannot cauſe. That of refraction, of which we are now going to reſume our examination, is equally ſurpriſing.

Let us begin by eſtabliſhing a clear idea of the things we are going to explain. Let us remember, that when light falls from a more rare and thin medium, as the air, into one more heavy and denſe, as the water, which in appearance ſhould reſiſt it more than the former, that the light quits its path or direction, and refracts in a line approaching to a perpendicular raiſed on the ſurface of the water.

To have a perfectly clear idea of this truth, obſerve the ray A E, (fig. 16) which falls from the air into this cryſtal. You know already in what manner it is refracted. The ray A E makes an angle with perpendicular B E in falling upon the ſurface of the cryſtal. The ſame ray refracted in the cryſtal makes another angle with the ſame perpendicular, which determines its refraction. It was neceſſary to meaſure this incidence and this refraction of the light. This ſeems very eaſy, though the Arabian geometer Alhaxen Vitellon, and even Kepler, failed in the attempt. Huygens, who was an eye witneſs, tells us that Snellius Villebrod was the firſt that diſcovered the conſtant proportion, according to which the rays are refracted in different mediums. He made uſe of ſecants. Deſcartes of ſines; which have preciſely the ſame proportion with the other. That proportion is very eaſy to be underſtood, even by thoſe who are ſtrangers to geometry.

The greater the line A B (fig. 16) is, the greater alſo will be the line C D. The line A B is called the ſine of incidence. The line C D is the ſine of refraction. This is not a proper place to explain in general what a ſine is. Thoſe who have ſtudied geometry know it already. Thoſe who have not, might find ſome difficulty in the definition. It will be ſufficient to obſerve, that thoſe two ſines, of whatſoever extent, are always in proportion to the given medium. Now that proportion is different, when the refraction is made in a different medium.

The light, which falls obliquely from the air into the cryſtal, is deflected there in ſuch a manner, that the ſine of refraction C D is to the ſine of incidence

A B, as two to three, which is no more than to ſay, that the line A B in this caſe is one third greater in the air, than the line C D in the cryſtal.

In the water the proportion is 3 to 4. Hence it is evident, that the cryſtal refracts the light one twelfth more ſtrongly than water. Conſequently in all caſes, and in all poſſible obliquities of incidence, cryſtal will be one half more refractive than water. The queſtion is to know not only the cauſe of refraction, but the cauſe of all theſe different refractions. On this all philoſophers have formed hypotheſes, and have been all miſtaken.

At length Newton alone diſcovered the true reaſon ſo long ſought. His diſcovery undoubtedly merits the attention of all ages. For the queſtion here does not only regard a particular property of light, tho' even that would have been a great acquiſition; we ſhall ſee that this property extends to all the bodies in nature. Conſider that the rays of light are in motion; that if they turn aſide in changing their courſe, it muſt be an effect of ſome primitive law, and that, nothing happens to light, but what happens to other bodies of the ſame tenuity as light, every thing elſe being equal.

Let a ball of lead A (fig. 17.) move obliquely from the air into the water, the contrary of what happened to the ray of light will happen to the ball; for that ſubtile ray enters the pores of the water, and the ball, whoſe ſuperficies is large, acts againſt the ſuperficies of the water which endeavours to buoy it up. This ball therefore removes at firſt from the perpendicular D B; but when it has entirely loſt the oblique motion impreſſed upon it, the ball is left to itſelf, and falls directly in a perpendicular line, from the point where it began to deſcend. Its fall is retarded in the water, becauſe the water reſiſts it; but the celerity of a ray of light is there, on the contrary augmented, becauſe the water makes no reſiſtance to the rays that penetrate it. There is then a power which acts between the body and the light.

That this attraction, this tendency exiſts, is not to be doubted; for we have ſeen light, attracted by glaſs, enter it again without touching any thing; now that power neceſſarily acts in a perpendicular line, that line being the ſhorteſt way. As this power exiſts, it exiſts in all the parts of matter. The parts of the ſuperficies of all bodies whatever, exert this power, before the ray enters or reaches the centre to which it is directed. Thus as ſoon as this ray arrives near the ſuperficies of the chryſtal, or the water, it begins to incline a little towards the perpendicular.

It refracts a little at C (fig. 18.) before its entrance; and the farther it enters the more it is refracted; becauſe the nearer it approaches, the more it is attracted. There is alſo a weighty reaſon why the ray neceſſarily inflects in an inſenſible curve, before it penetrates the cryſtal in a right line. This reaſon is, there is no angle, ſtrictly ſpeaking, in nature; a continued motion cannot change its direction, but by paſſing through every poſſible degree of change. It cannot therefore paſs ſuddenly from one ſtrait line into another, without making a little curve by which theſe two lines are connected. In this phænomenon, therefore, are united the principle of continuity eſtabliſhed by Leibnitz, and the attraction of Newton. This ray then does not fall quite perpendicularly, and in paſſing the water, or cryſtal, does not follow its oblique line, but another that partakes of both, and deſcends with greater velocity according to the ſtrength of the attraction of the water or cryſtal. Therefore the water is ſo far from refracting the rays of light by its reſiſtance, as was imagined, that it really refracts them by attracting inſtead of reſiſting them. The rays then muſt be ſaid to refract towards the perpendicular, not as coming from a more reſiſting medium, but on their paſſing *from a medium leſs attractive to a medium more attractive*. Obſerve that by this word attractive muſt be underſtood only the point towards which, by a known force, an indiſputable property of matter, it directs itſelf; and this property is very ſenſible between light and other bodies. Let it be conſider'd that ever ſince the year 1672, when Newton diſcovered this attraction, no philoſopher has been able to invent one plauſible reaſon for this refraction of light.

Some tell you, that cryſtal refracts the rays of light by its reſiſtance; but if it reſiſts them, how can thoſe rays enter it more eaſily, and with a greater velocity? Others talk of a matter in cryſtal, which on all ſides opens more eaſy paſſages. But if theſe paſſages are every where ſo eaſy, why does not the light enter without any refraction. Theſe imagine atmoſpheres, thoſe vortices; but all their ſyſtems are defective in ſome part or other. I believe, therefore, we muſt be contented with Newton's diſcovery, with this viſible attraction, of which neither he, nor any other philoſopher, has been able to find the cauſe.

You are ſenſible, that abundance of people, as much attached to the philoſophy, or rather the name, of Deſcartes, as they were formerly to the name of Ariſtotle, have declared againſt attraction. Some would not ſtudy it; others deſpiſed and condemned it, almoſt before examination; but I beg the reader to make the three following reflections.

1. What are we to underſtand by attraction? Nothing more than a force by which one body approaches another, without any other force being ſeen or known to impel theſe bodies.

2. This property of matter is received by the beſt philoſophers in England, Germany, Holland, and even in many Univerſities of Italy, where laws of a rigorous nature ſometimes obſtruct the avenues to truth. The conſent of ſo many learned men is indeed no proof; but, at the ſame time, it is a ſtrong reaſon for examining at leaſt, whether this power does or does not exiſt.

3. We ought to ſuppoſe that we are equally ignorant of the cauſe of impulſion, as we are of attraction. We have not even a clearer idea of the one than of the other of thoſe powers; for no body can conceive why a body has the power of moving another from its place. Neither can we more eaſily conceive why the parts of matter mutually gravitate towards each other. Newton himſelf did not pretend to know the reaſon of this

attraction. He has only proved its exiſtence: he ſaw a conſtant phænomenon, an univerſal property in matter. If a man diſcovers a new metal in the earth, would this metal exiſt the leſs becauſe the firſt principles of it were unknown?

Attraction is often ſaid to be an occult quality. If by this word be meant a real principle, which cannot be accounted for, it may be extended to the whole univerſe. We know not how motion happens, how it is communicated, how bodies are elaſtic, how we think, how we live, nor how nor wherefore all things exiſt. Every thing is an occult quality. If by this word be meant an expreſſion of the ancient ſchools, a word without idea; let it only be conſidered, that it is by the moſt ſublime and moſt preciſe mathematical demonſtrations, that Newton has diſplayed to the world this principle, which ſome have ſo injuriouſly endeavoured to explode as a chimera.

We have already ſeen, that this ray of light reflected to us from a mirror, cannot be reflected from its ſurface. We have ſeen experimentally, that the rays, tranſmitted by a glaſs to a certain angle, return inſtead of paſſing into the air; that, if there be a vacuum behind the glaſs, the rays which were tranſmitted before, returns from that vacuum to us. In this caſe there is certainly no impulſion. Another power muſt neceſſarily be admitted; and at the ſame time, we muſt inevitably admit, that there is ſomething in refraction not hitherto underſtood. Now what power is that, which inflects a ray of light in a baſon of water. It is demonſtrated (as we ſhall ſhew in the following chapter) that, what had hitherto been believed a ſingle ray of light, is a pencil of ſeveral rays, and all differently refracted. If one of the rays of light contained in this pencil is refracted, for inſtance, at four degrees diſtance, another will be at three degrees from a perpendicular. It is demonſtrated, that the moſt refrangible, that is, thoſe which in being refracted on quitting the glaſs, and in taking a new direction in the air, go fartheſt from the perpendicular of that glaſs, are alſo thoſe which are the moſt reflected and with the greateſt eaſe.

It is therefore very probable, that the ſame law which occaſions the reflection, occaſions alſo the refraction of light.

In fine, if we find ſtill ſome new property of light, which appears to derive its origin from the force of attraction, ought we not to conclude that ſo many effects proceed from the ſame cauſe? This new property was diſcovered by father Gremaldi, the Jeſuit, about the year 1660, and upon which Newton has carried his inquiries ſo far as to meaſure the ſhadow of an hair at different diſtances. This property is the inflection of light. The rays not only refract in paſſing the medium, whoſe ſubſtance attracts them; but other rays, which paſs in the air near the edges of the attracting body, ſenſibly approach it, and viſibly turn aſide from their courſe or direction. Put a lamina of ſteel (fig. 19.) or thin glaſs ending in a point, in a dark place; let it be ſet near a little hole through which the light paſſes; and let the light almoſt touch the point of this piece of ſteel or glaſs; the rays will bend in ſuch a manner near it, that the ray next the point will be more curved, and the fartheſt from it leſs ſo in proportion. Is it not highly probable, that the ſame power, which refracts theſe rays, when in this medium, forces them to incline towards it, and quit their direction, when they are near it? Thus we ſee refraction, tranſparence, and reflection ſubjected to new laws; and an inflection of light reſulting evidently from attraction. Thus a new univerſe preſents itſelf to the eyes of thoſe who are willing to ſee it.

We ſhall ſoon ſhew, that there is an evident attraction between the ſun and the planets, and a mutual tendency of all bodies towards each other. But it is proper to obſerve here, that this attraction, which cauſes the gravitation of the planets towards the ſun, does not at all act in the ſame ratio's, as the attraction of corpuſcles which touch each other. They are probably even different ſpecies of attraction. They are new and different properties of light and bodies, diſcovered by Newton. Their cauſe is not conſidered here, we are only concerned with their effects hitherto unknown. Let it not be thought, that light is inflected towards the cryſtal and in the cryſtal, in the ſame manner as mars is attracted by the ſun.

CHAP. VIII.

SEQUEL OF THE WONDERS OF THE REFRACTION OF LIGHT. THAT ONE RAY OF LIGHT CONTAINS IN ITSELF ALL POSSIBLE COLOURS. WHAT REFRANGIBILITY IS. NEW DISCOVERIES.

Deſcartes's imagination with reſpect to colours. Error of Mallebranche. Newton's experiment and demonſtration. Anatomy of light Colours in the primitive rays. Weak objections againſt theſe diſcoveries. Criticiſms ſtill weaker. Important experiment.

IF you aſk of the philoſophers the cauſe of colours, Deſcartes will tell you, *That the globules of his elements are determined to turn round upon themſelves, with velocity, beſides their tendency to motion in a right line, and that thoſe different whirlings round are the cauſe of different colours.* But, in reality, what are his elements his globules and whirlings, do they require the touchſtone of experiment to prove them falſe? A multitude of demonſtrations annihilate theſe chimeras.

Mallebranche in his turn tells us: *It is true Deſcartes deceived himſelf. His whirlings of globules is not to be maintained; but they are not globules of light, they are little vortices of ſubtile matter, capable of compreſſion, which are the cauſe of colours; and colours conſiſt, like ſounds, in the vibrations of that preſſure.* He adds, *To me it ſeems impoſſible to diſcover by any means the exact* *proportions of theſe vibrations*, that is, of colours. You will remark that he ſpoke in this manner in the academy of ſciences in 1699; and that theſe proportions had already been diſcovered in 1675, not proportions of little vortices which do not exiſt; but proportions of the refrangibility of the rays, which forms colours, as we ſhall preſently ſhew. What he believed impoſſible, was already demonſtrated, and what is more, demonſtrated to the eye, acknowledged true by the ſenſes, which would have highly diſpleaſed father Mallebranche.

Other philoſophers, perceiving the fallacy of theſe ſuppoſitions, tell us, at leaſt with more probability: *Colours are produced by the rays of coloured bodies more or leſs reflected. White reflects moſt, and black leaſt of them all. The moſt ſhining colours therefore are thoſe which emit moſt rays to the eye. Red, for inſtance, which fatigues the ſight a little, ought to conſiſt of more rays than green, which gives it moſt repoſe* This hypotheſis (already ſuſpected for being an hypotheſis) appears to be a very groſs error, merely by viewing a picture in a faint, and afterwards in a very full light; for the ſame colours are ſtill ſeen. White enlightened only by a ſingle taper is ſtill white; and green illuminated with a thouſand tapers will be always green.

Let us apply to Newton. He will ſay: do not believe me; believe only your eyes, and the mathematics: place yourſelves in a room totally darkened, into which the light comes only thro' a hole exceedingly ſmall; the ray of light falling upon paper will give you the colour white. Place a priſm of glaſs (fig. 20) tranſverſely to a ray of light; then at the diſtance of about ſixteen or ſeventeen feet, fix the ſheet of paper P oppoſite to the priſm. You know already that light is refracted on entering the priſm from the air, you know that it refracts in a contrary manner in paſſing from the priſm into the air. If it was not refracted it would fall from the hole upon the floor of the room Z. But as this light in paſſing from the priſm muſt remove from the line Z, it will conſequently ſtrike the paper. Here then appears the whole ſecret of light and colours. The ray, which falls upon the priſm is not, as we believed, a ſingle ray, but a pencil, conſiſting of ſeven principle bundles of rays, each of which carries in itſelf a primitive or primordial colour peculiar to itſelf. From that mixture of the ſeven rays flow all the colours in nature; and the whole ſeven united, and reflected together from one object, form whiteneſs.

Let us trace this admirable artifice to the bottom. We have already inſinuated, that the rays of light are not all refracted equally, of which this is an evident demonſtration to the eyes. The ſeven rays of light having quitted the body of the ray, which is anatomized at paſſing from the priſm, place themſelves each in their order, upon the white paper, each ray occupying an oval. The ray which has leaſt force, rapidity, and matter, to keep its direction, removes moſt in the air from the perpendicular of the priſm. That which is the ſtrongeſt, (fig. 21.) moſt denſe, and moſt vigorous, removes leaſt from it. Obſerve theſe ſeven rays, which are refracted one above another; each of them paints upon the paper the primitive colour peculiar to itſelf. The firſt ray which removes leaſt from the perpendicular of the priſm, is the colour of fire, the ſecond orange, the third yellow, the fourth green, the fifth blue, the ſixth indigo, and the laſt, which removes moſt from the perpendicular, and riſes above all the reſt, is the violet. A ſingle group of light, which at firſt compoſed only whiteneſs, is therefore one conſiſting of ſeven pencils of rays, which have each their peculiar colour. The aſſemblage of ſeven primordial rays, therefore, is what compoſes white.

If this be ſtill doubted, take a lentular ſpectacle-glaſs, which collects all the rays in its focus: place this glaſs upon the hole at which the light enters, and you will never ſee any thing at the focus but a round ſpot of white. Place the ſame glaſs at the point, where it can collect all the ſeven rays that paſs through the priſm. It unites, as you ſee, thoſe ſeven rays in its focus, (fig. 22.) The colour of thoſe ſeven rays is white which demonſtrates, that the colour of all the rays united is whiteneſs. Conſequently, the body which reflects no light will be black: for when, by the help of the priſm, we have ſeparated ſome of theſe primitive rays, though we make them fall upon a mirror, a burning-glaſs, or any other priſm, they will never change their colour, nor ſeparate into other rays. To contain ſuch a colour is their eſſence, nothing can alter them more; and as a ſuperabundant proof, if we take ſilk threads of different colours, and lay one of them, a blue one for inſtance, in the red ray, the blue ſilk will become red. Put the ſame in the yellow ray, it becomes yellow; and ſo on with the reſt. In fine, neither refraction, reflection, nor any other means conceivable, can change this primitive ray, being as unalterable, or rather more ſo, than gold proved in the crucible.

This property of light, this inequality in the refraction of its rays, is what Newton calls Refrangibility. At firſt its exiſtence was oppoſed, and continued to be denied a long time; becauſe Mr. Mariote had erred in making Newton's experiments in France. People were better pleaſed to ſay, that Newton had boaſted of having ſeen what he had not ſeen, than to think Mariote had not taken proper methods for ſeeing the ſame, and had not been happy enough in the choice of his priſms. Even afterwards, when theſe experiments had been well made, and truth had ſhewn itſelf to our eyes, prejudice ſtill ſubſiſted to ſuch a degree, that in ſeveral journals and books publiſhed ſince the year 1730, the ſame experiments are confidently denied, though made by all Europe every day. In the ſame manner, after the diſcovery of the circulation of the blood, theſes were maintained againſt that truth, and the perſons who explained the new diſcovery called *circulators*, by way of ridicule. In fine, when obliged to yield to evidence, they own they have ſeen the fact, but cavil at the expreſſion: they have declared war againſt the term refrangibility, as well as againſt thoſe of attraction and gravitation. But what ſignifies the term, provided it implies a truth? When Chriſtopher Columbus diſcovered the iſland Hiſpaniola, had he not a right to call it by whatever name he thought proper? And have not inventors an equal right to name what they create or diſcover? People have decried and wrote againſt words, which Newton uſed with the wiſeſt precaution to prevent errors.

He calls theſe rays, red, yellow, *&c. rubrific, flavific* rays, that is, exciting the ſenſation of red, yellow, *&c.* His deſign in this was to ſtop the mouths of thoſe, who ſhould have the ignorance, or injuſtice, to pretend he believed with Ariſtotle, that colours are in the things themſelves, in the yellow and red rays, and not in our mind. He had reaſon to apprehend this accuſation. I have met with perſons, and thoſe of ſome merit too, who have aſſured me, that Newton was a peripatetic, that he thought the rays themſelves actually coloured, as fire was formerly believed hot: but the ſame critics alſo aſſured me, that Newton was an atheiſt. It is true they had not read his works, but they had heard them ſpoken of by others, who had wrote againſt his experiments without having ſeen them.

The ſofteſt treatment Newton at firſt met with was, to term his ſyſtem an hypotheſis. But what is an hypotheſis? A ſuppoſition. Indeed can we give the name of ſuppoſition to facts ſo often demonſtrated? Is it from our being born in France, that we negle[illegible] truths conveyed to us by an Engliſh hand? This would be highly unworthy a philoſopher. To a ſtudious perſon there is neither French nor Engliſh: whoever inſtructs us becomes our countryman.

Refrangibility and reflection evidently depend on the ſame cauſe. This refrangibility we have been conſidering, being annexed to refraction, muſt flow from the ſame principle. The ſame cauſe muſt preſide over the motion of all theſe ſprings: ſuch is the order of nature. All vegetables are nouriſhed by the ſame laws: all animals have the ſame principles of life. Whatever may happen to bodies in motion, the laws of motion are invariable. We have already ſeen that reflection, refraction, and inflection of light, are the effects of ſome power; but not impulſion (at leaſt known.)

known.) The ſame power ſhews itſelf in refrangibility; theſe rays ſcattered to different diſtances, indicate that the medium, through which they paſs, acts on them unequally: the pencil of rays is attracted into the glaſs; but this pencil is compoſed of unequal maſſes. Theſe maſſes are therefore unequally attracted; if ſo, they muſt be reflected from the priſm, in the ſame order they were refracted in it. The moſt reflexible rays being the moſt refrangible.

The priſm has thrown the ſeven colours upon the paper; turn the priſm upon itſelf in the manner A, B, C, Fig. 23 and you will preſently have the angle, according to which all light will be reflected from the inſide to the outſide of the priſm, inſtead of being thrown upon the paper. As ſoon as you begin to approach that angle, you ſee, on a ſudden, the violet ray quit the paper, and riſe to the cieling. After the violet, the purple does the ſame; after the purple, the blue; and ſo on, till the red quits its place upon the paper laſt, and is reflected to the cieling in its turn. Every ray, therefore, is more reflexible, in proportion as it is more refrangible: conſequently the ſame cauſe produces reflection and refrangibility.

Now the ſolid part of the glaſs occaſions neither this refrangibility, nor this reflection: once more then theſe properties have their riſe in ſome other cauſe, than the impulſion known to us upon the earth. There is nothing to be ſaid againſt theſe experiments; we muſt ſubmit to them, however tenacious we are againſt evidence.

CHAP. IX.

OF THE RAINBOW. THAT METEOR IS A NECESSARY EFFECT OF THE LAW OF REFRANGIBILITY.

Mechaniſm of the rainbow wholly unknown to antiquity. Ignorance of Albertus Magnus. *The archbiſhop* Antonio de Dominis *was the firſt who explained the rainbow. His experiment imitated by* Deſcartes. *Refrangibility ſole cauſe of the Rainbow. Explanation of that phænomenon. Two rainbows. The phænomenon always ſeen in a ſemicircle.*

THE rainbow, or iris, is a neceſſary effect of the properties of light, we have juſt been obſerving. There is nothing in the writings of the Greeks, Romans, or Arabians, that gives us any reaſon to believe, they knew the cauſe of this phænomenon. Lucretius ſays nothing of it; and by all the abſurdities, which he utters in the name of Epicurus, upon light and viſion, it appears, that his age, ſo polite in other reſpects, was profoundly ignorant with regard to philoſophy. They knew, that to ſee what we call the rainbow, or iris, a thick cloud is neceſſary, diſſolving in rain before the rays of the ſun; and that our eyes ſhould be between that luminary and the cloud. *Mille trahit varios adverſo ſole colores*; but this was all they knew; nobody imagined either why a cloud exhibited colours, how the nature and order of thoſe colours are determined, or why we always ſee that phænomenon under the form of a ſemi-circle.

Albertus, ſurnamed Magnus, becauſe he lived in an age when men knew very little, imagined that the colours of the rainbow proceeded from a dew between us and the cloud; and that thoſe colours, received upon the cloud, were tranſmitted by it to us. You will obſerve beſides, that this Albertus Magnus believed, with all the ſchools, that light was an accident.

At length the celebrated Antonio de Dominis, Archbiſhop of Spalatro in Dalmatia, expelled from his biſhopric by the inquiſition, about the year 1590, wrote his little treatiſe, *De Radiis Lucis & de Iride*, which was not printed at Venice till twenty years after. He was the firſt who ſhewed, that the rays of the ſun, reflected even from the inner part of the drops of rain, formed theſe colours that appeared in the bow, which ſeemed an inexplicable miracle: he rendered the miracle natural, or rather he explained it by new prodigies of nature. His diſcovery was ſo much the more ſingular, as in other reſpects he had very falſe notions of the manner in which viſion is performed. He aſſures us in his book that the images of objects are in the ball of the eye, and that there is no refraction in it: a notion ſingular enough for a good philoſopher! He had diſcovered refractions, unknown before, in the drops of the rainbow, and denied thoſe formed in the humors of the eye, of which himſelf began the demonſtration: but let us leave his errors to examine the truth he diſcovered.

He ſaw with a ſagacity very uncommon in thoſe days, that every row or circle of drops of rain, muſt tranſmit from the rainbow, the rays of light in different angles; he alſo ſaw, that the difference of thoſe angles muſt occaſion that of the colours: he found means to meaſure the quantity of thoſe angles: he took a very tranſparent cryſtal ball, which he filled with water, and hung up at a certain height expoſed to the rays of the ſun. Deſcartes, who followed Antonio de Dominis and rectified and ſurpaſſed him in ſome things, who perhaps ought to have quoted him, made alſo the ſame experiment. When this ball is ſuſpended at ſuch an height, that the ray of light, which falls from the ſun upon the ball, makes an angle with the ray that flows from the ball to the eye of forty-two degrees two or three minutes, the ball always exhibits a red colour. When that ball is ſuſpended a little lower, and thoſe angles are ſmaller, the other colours of the rainbow appear ſucceſſively in ſuch a manner, that the greateſt angle in this caſe forms the red, and the ſmalleſt of forty degrees ſeventy minutes forms the violet. This is the foundation of the knowledge of the rainbow; but at the ſame time it is no more than the foundation.

Refrangibility alone explains the reaſon of a phænomenon ſo common, ſo little known, and of which few beginners have a clear idea: let us endeavour to render the thing obvious to all the world. Let us ſuſpend a ball of cryſtal, full of water, expoſed to the ſun: let us place ourſelves between the ſun and the ball: why does this ball tranſmit colours to me; and why particular colours? great quantities of light, millions of pencils of rays fall from the ſun upon this ball; in each of theſe pencils there are primitive rays, homogeneous rays, many red, many yellow, many green, &c. all which refract at their incidence into the ball, each differently, and according to its ſpecies, and the place in which it enters. You already know, that the red rays are the leaſt refrangible; the red rays of a certain determinate pencil will therefore unite at the bottom of the ball, whilſt the blue and purple rays of the ſame pencil will do the ſame elſewhere. Theſe red rays will alſo quit the ball at one place, and the green, blue, and purple at another. This is not enough: we muſt examine the points where thoſe red rays fall both at entering, and in quitting the ball to come to the eye.

To make this as clear as poſſible, let us conceive this ball, as it really is, an aſſemblage of an infinite number of plain ſurfaces; for the circle being compoſed of an infinite number of points infinitely ſmall, the circumference of the ball is only an infinity of ſuch ſurfaces. The red rays A, B, C, (Fig. 24) fall parallel from the ſun upon thoſe three ſmall ſurfaces.

Is it not true that each of them refracts according to its degree of incidence. Is it not evident that the red ray A, falls more obliquely upon its little ſurface, than the red ray B, thus both come to the point R by different directions. The red ray C, falling upon its little ſurface, ſtill leſs obliquely than the two former, is much leſs refracted and arrives alſo at the point R, with very little incurvation. I have now three red rays, that is three pencils of red rays, which terminate at the ſame point R. At this point R, each of them forms an angle of reflection equal to its angle of incidence; each is refracted at emerging from the ball in a line removing from the perpendicular of the new little ſurface it approaches, in the ſame manner as each is refracted at its incidence in lines, approaching their perpendiculars; all therefore return parallel, and enter the eye according to the quantity of the angle peculiar to the red rays. If there be a ſufficient quantity of theſe homogeneous red rays to ſtrike the optic nerve, we muſt doubtleſs have the ſenſation of red. Theſe red rays A, B, C, are termed the viſible and the efficacious rays of that drop, for each drop has its viſible rays.

There are thouſands of other red rays, which falling upon other little ſurfaces of the ball, higher and lower, or which falling on the ſame ſurfaces at another obliquity, do not terminate in R; theſe are loſt to you, but will be ſeen by other eyes placed higher or lower.

Abundance of orange, green, blue, and violet rays have fallen indeed with the viſible red ones upon the ſurfaces, A, B, C; but you cannot perceive them. You know the reaſon, which is, their being all more refrangible than the red rays; it is becauſe in entering all at the ſame point, each of them takes a different path in the ball; as they are all more refracted, they come below the point R, and refract alſo more than the red ones in quitting the ball. The ſame power, which in the inſide of the ball cauſed them to approach in a line further from the perpendicular of each ſurface, diſperſes them more at their return into the air: they all return therefore above the eye; but lower the ball, and the angle becomes leſs. Let this angle be of forty degrees and above ſeventeen minutes, and you will ſee no colour but the violet.

There is no perſon who, upon this principle, may not eaſily conceive the doctrine of the rainbow: imagine ſeveral rows or circles of drops of rain; every drop has the ſame effect as this ball.

Caſt your eyes upon the bow R, V, P, (fig. 25) and to avoid confuſion, conſider only three rows of drops, three coloured circles. It is evident that the angle P, O, L, is leſs than the angle V, O, L, and that the angle R, O, V, is the greateſt of the three. The greateſt angle of the three is therefore that of the red primordial rays: that in the middle is the primitive green; and the laſt P, O, L, is the primitive purple. We therefore muſt ſee the rainbow red on its external, green on its middle, and purple and violet on its internal circles. Obſerve only, that the laſt circle, the violet, is always tinged with the whitiſh colour of the cloud in which it loſes itſelf.

It is eaſy to conceive then, that we ſee the drops only in the efficacious or viſible rays, which come to the eye after one reflection and two refractions in determinate angles. If we change the place of the eye, and inſtead of being in O, bring it to T, we no longer ſee the ſame rays: the circle which before was red is now become orange or green, and ſo on with the reſt: at every motion of the head you ſee a new iris.

The firſt rainbow being well underſtood, we ſhall eaſily comprehend the ſecond, which is generally ſeen encircling the firſt, and which is called the falſe rainbow, becauſe its colours are not ſo lively, and at the ſame time reverſed in their order to thoſe of the other. For the appearance of two rainbows, it is enough that the cloud which forms them be ſufficiently thick and extended. That bow which appears above the firſt and ſurrounds it, is formed in like manner, by the rays, which the ſun darts into the drops of rain, and which are refracted and reflected in them in ſuch a manner, that each row of drops tranſmits alſo primitive rays to the eye; this drop a red, and that a violet ray. Every thing, in this great bow, however, is the reverſe of what paſſes in the ſmaller; but why? becauſe your eye, that receives the ſenſible or efficacious rays of the ſmaller bow, which fall from the ſun into the upper part of the drops, receives, on the contrary, the rays of the greater bow from the lower part of the drops.

You ſee, that the drops of water of the ſmaller bow receive the rays of the ſun upon the ſuperior part of each drop; (Fig 26.) the drops of the greater bow, on the contrary, receive the rays, that reach them, on their lower part. Nothing, in my opinion, will be more eaſy to conceive, than the manner in which the rays are twice reflected in the drops of the greateſt rainbow; and how thoſe rays twice refracted and twice reflected exhibit an iris reverſed in the order of its colours, and fainter than the former. You have juſt ſeen that the rays enter thus into the lower part of the drops of water of this exterior iris.

A pencil of rays falls on the ſuperficies of the drop in G: (Fig. 27) a part of thoſe rays are refracted there within, and another ſcattered without; thus the eye has already loſt part of thoſe rays. The part refracted comes to H, one half of this part is diſperſed in the air on quitting the drop, and is again loſt to the eye. The little that remains in the drop is tranſmitted to K, there a part of it again eſcapes: this is a third diminution. What has remained of it in K, is tranſferred to M, and emerging there to M, a part of it is again diſſipated: fourth diminution. And what remains comes to the eye at laſt in the line M, N. Thus we ſee in this drop as many refractions as in the drops of the ſmaller bow; but there are, as we have ſhewn, two reflections inſtead of one in this greater bow; twice the light, therefore, is loſt in the greater bow, in which the light is twice reflected, while leſs by one half is loſt in the ſmaller bow, where the drops are only once reflected. It is, therefore, demonſtrated, that the exterior rainbow muſt always be fainter by one half in its colours than the ſmaller within it. It is alſo demonſtrated, by the double reflection of the rays, that

they

hey muſt come to the eye in a manner oppoſite to that f the firſt bow; for your eye is placed in O. (Fig 28.) n this place, O, it receives the leaſt refrangible rays f the firſt exterior circle of the ſmaller bow, and muſt eceive the moſt refrangible of the firſt circle of the econd greater bow: theſe moſt refrangible rays are the iolet. Thus, then we have here the two rainbows in heir natural order, giving them only three colours to void confuſion.

It only remains to know why thoſe colours are always perceived in a circular figure. Conſider this ine O Z. (fig. 29) which paſſes thro' your eye. Conceive the two balls R V, to move always at equal iſtances from your eye, they will deſcribe the baſes f cones, of which the apexes will always be in your ye. Conceive that the ray of the drop of water R, oming to your eye O, turns round O Z, as an axis, naking always an angle with your eye of forty two egrees two minutes; it is plain this drop will deſcribe a circle, which will appear red. Suppoſe the rop O to revolve in the ſame manner, making always nother angle of forty degrees ſeventeen minutes, it will orm a violet circle; all the drops therefore in this lane will form a violet circle, as thoſe in the plane of he drop R, will a red one. We ſee therefore this iris s a circle, but not as an entire circle; becauſe the earth nterſects it, we ſee only an arch, the ſection of a circle.

Neither *Antonio de Dominis* nor Deſcartes could penetrate any farther into moſt of theſe truths: they ould not diſcern the reaſon why theſe different angles exhibited different colours; but it was a great deal o have diſcovered the art. The perfection of arts is eldom owing to the firſt inventors. Not being able herefore to gueſs that colours depended on the refrangibility of rays, that each ray contained a primitive olour in itſelf, that the different attraction of thoſe ays occaſioned thoſe removals which formed the different angles. Deſcartes had recourſe to his ſpirit of nvention for explaining the colours of the rainbow. n order to this he employed the imaginary *vortices of globules*

globules and that *tendency to a vortex*; proofs of genius, bu proofs of error. Thus to explain the *ſyſtole* and *diaſtol* of the heart, he imagined a motion and conformation of that organ, of which all anatomiſts have proved the falſity. *Deſcartes* would have been the greateſt philoſopher in the world, if he had made leſs uſe of invention.

CHAP. X.

NEW DISCOVERIES ON THE CAUSE OF COLOURS WHICH CONFIRM THE PRECEDING DOCTRINE. DEMONSTRATION THAT COLOURS ARE OCCASIONED BY THE THICKNESS OF THE PARTS OF WHICH BODIES ARE COMPOSED, THO' THE LIGHT IS NOT REFLECTED FROM THESE PARTS.

More profound inquiry into the formation of colours. Great truths drawn from a common experiment. A experiment made by Newton. Colours depend on th thickneſs of the parts of bodies, tho' theſe parts do n themſelves reflect the light. All bodies are tranſparent. Proof that colours depend on thickneſſes, tho' the ſoli parts do not reflect the light.

FROM what has been already ſaid it follows, that all colours proceed from a mixture of the ſeven primordial colours, of which the rainbow and the priſm give us a diſtinct view.

The bodies that are moſt proper to reflect the red rays, and whoſe parts abſorb or tranſmit the other rays, will be red; the ſame may be obſerved of the reſt. The meaning of this is not that the red rays are actually reflected by the parts of theſe bodies; but that there is a power, a force hitherto unknown, which reflects theſe rays from about the ſurfaces and pores of bodies.

Colours then are in the rays of the ſun, and return to us from the ſurfaces and pores of bodies and from the vacuum. Let us now inquire in what this apparent power of bodies to reflect theſe colours conſiſts; what occaſions ſcarlet to appear red, why the meadows are green, and why a clear heaven is blue: For to ſay that this proceeds from the difference of the form of their parts, is to advance an indeterminate notion, that has no tendency to increaſe our knowledge.

A childiſh diverſion, that ſeems to have nothing in it but what is contemptible, gave Sir *Iſaac Newton* the firſt idea of theſe recent truths which we are now to explain. Every thing to a philoſopher ſhould be a ſubject of meditation, and nothing deſpicable in his eyes. He perceived, that in thoſe bubbles of ſoap and water blown by children, the colours changed every moment, paſſing downwards ſucceſſively from the top of the bubble, in proportion as the thickneſs of it diminiſhed, till at laſt the weight of the water and ſoap, which continually fall to the bottom, breaks the equilibre of that light ſphere, and cauſes it to vaniſh. Hence he reaſoned, that colours might probably depend on the thickneſs of the parts that compoſed the ſurfaces of bodies; and to aſſure himſelf of it, he had recourſe to the following experiments.

Let two glaſſes touch one another in only one point. They need not be both convex; it is ſufficient that the firſt be ſo, and that it be placed upon the other. Let water be put between theſe two glaſſes to render the experiment more ſenſible, which is made in the air. When the glaſſes are preſſed a little againſt each other a ſmall, tranſparent, black ſpot appears at the point of their contact. From this point, ſurrounded with a little water, coloured circles form themſelves, in the ſame order and manner as in the bubble of diluted ſoap. In a word, by meaſuring the diameter of the circles, and the convexity of the glaſs, *Newton* calculated the different thickneſs of the portions of water which produced theſe different colours. He found the thickneſs neceſſary to reflect white, to be about four ſuch parts of an inch as the diviſion of it into a million would produce: the azure, blue, and the colours bordering upon a violet, depend on a thickneſs yet conſiderably leſs. Thus the pureſt vapors raiſed from the earth, and which colour the air without clouding it, being of a very thin ſurface, produce that celeſtial blue which charms our ſight.

Other experiments finiſhed this diſcovery, and proved that colours are attached to the thickneſs of ſurfaces. The ſame body that was green when ſomewhat thick, becomes blue, when rendered thin enough to reflect nothing but blue rays, and to tranſmit all the others. Theſe truths, of ſo delicate a nature and which ſeem to conceal themſelves from human ſight, well deſerve to be cloſely purſued: This part of philoſophy is a microſcope, by which the mind diſcovers magnitudes infinitely ſmall.

All bodies are tranſparent; we need only to reduce them to a proper tenuity, and then the rays of light finding nothing more than a thin plate, a leaf to paſs through, make their paſſage accordingly. Thus when a leaf of gold is placed againſt a ſmall hole in a dark chamber, it reflects from its ſurface the yellow rays, which cannot paſs through its ſubſtance, and tranſmits green rays into the room: gold then produces a green colour; a farther confirmation, that colours depend on the difference of denſities. But a ſtill ſtronger proof of the ſame thing is, that in the experiment of the two glaſſes, which are made to touch in one point only; water here is not the only element that produces different colours according to its different denſities; the air produces the ſame effect, only the coloured circles formed between the two glaſſes, have a larger diameter than thoſe of the water. There is a ſecret proportion therefore, eſtabliſhed by nature, between the force of the conſtituent parts of all bodies, and the primitive rays which colour thoſe bodies: the thinneſt bodies give the moſt feeble colours, and to reflect a black, the ſame thickneſs, or rather the ſame tenuity, the ſame thinneſs is requiſite, as that which conſtitutes the very top of a bubble of diluted ſoap, in which a little black ſpot is perceived; or even the ſame as is in the point of contact between the convex and the flat glaſs, which contact produces alſo a black ſpot.

It muſt not however be imagined that bodies reflect the light by their ſolid parts, becauſe we have ſhewn that colours depend on the denſity of theſe parts. There is a power attached to that denſity, a power that acts near the ſurface; but it is not that ſolid ſurface, that repels, that reflects. It ſeems to me, that the reader ſhould have now reached a point, where nothing ought to ſurpriſe him for the future. But what he has juſt ſeen will lead him farther than he may imagine; ſo many ſingularities being, if we may uſe the expreſſion, but the frontiers of a new world.

CHAP. XI.

CONSEQUENCES OF THESE DISCOVERIES. MUTUAL ACTION OF BODIES ON LIGHT.

Remarkable experiment: Conſequences of theſe experiments. Mutual action of bodies on light. All this theory of light agrees with the theory of the univerſe. More properties in matter than is apprehended.

THE reflection, inflection, refraction, and refrangibility of light are known, the origin of colours is diſcovered, and even the thickneſs of bodies neceſſary to occaſion certain colours, is determined.

It is a property demonſtrated both to the mind and ſight, that ſolid ſurfaces are not what reflect the rays. For did ſolid ſurfaces really reflect, 1. the point of contact between two convex glaſſes would reflect, and not be obſcure. 2. Each ſolid particle reflecting only one ſpecies of rays, would at the ſame time reflect all ſpecies of rays. 3. Solid particles would not tranſmit light in one place and reflect it in another; for being all ſolid, they would all reflect. 4. If the ſolid particles reflected light, it would be impoſſible to ſee ourſelves in a mirror, as we have already obſerved: for the mirror being furrowed and rugged, it could not reflect the light regularly. There is then undoubtedly a power acting on bodies, without touching bodies; and this power acts between bodies and light. In ſhort, ſo far is light from rebounding on the very bodies and returning to us, that moſt of the rays which ſtrike ſolid bodies remain there, and become loſt and extinguiſhed.

We ſhall not extend this introduction to the doctrine of light any farther. Perhaps as a piece merely elementary, we have been already too large on the ſubject; but many of theſe truths were new to moſt readers, when this work was firſt publiſhed. Before we proceed to the other parts of Newton's philoſophy, let us remember, that the theory of light has ſomething in common with the theory of the univerſe, on which we are going to enter. This theory is, that there is a kind of attraction obſerved between bodies and light; and it will appear that there is the ſame between all the globes of the univerſe. Theſe attractions ſhew themſelves by different effects; but is always a tendency of bodies towards one another, diſcovered by the aſſiſtance of experiment and geometry.

Theſe diſcoveries ſhould, at leaſt, render us extremely circumſpect in our deciſions concerning the nature and eſſence of things. We ſhould remember that we know nothing but from experience. Without the ſenſe of feeling we ſhould have no idea of the extent of bodies: without the ſight we could never have conceived any notions of light: had we never felt motion, we ſhould never have believed matter moveable. A very ſmall number of ſenſes given us by God ſerves to diſcover to us a very ſmall number of the properties of matter. The ſenſes wanting, reaſon ſupplies; and farther informs us, that matter has other properties, as attraction and gravity; nor is it improbable but it may have others inherent in its nature, and of which philoſophy may, perhaps, one day impart ſome ideas.

For my part I own, that the more I reflect on it, the more I am ſurpriſed at any reluctance in owning a new principle, a new property in matter. It may perhaps contain new principles and new properties *ad infinitum*. No one thing in nature reſembles another; It is very probable that the creator has made water, fire, air, earth, vegetables, minerals, animals, &c. on principles and plans entirely different. It is ſtrange that we ſhould revolt againſt the author of new treaſures; for is it not enriching man to diſcover new qualities in the matter of which he is formed?

LETTER FROM THE AUTHOR,

Which may ſerve as the laſt chapter to the theory of light.

CONTINUAL diſeaſes, which exerciſe my patience, more than Newton exerciſes my mind, have hindered me from doing myſelf the honour of anſwering your letter ſooner. I believe, Sir, that your doubts would alſo have raiſed doubts in him. You ſay it is pity he has not more clearly explained himſelf with regard to the reaſon, why the attractive force often becomes repulſive; and with regard to the power by which the rays of light are darted with ſuch amazing celerity. And I would venture to add, that it is pity, he could not diſcover the cauſe of thoſe phænomena. Newton, the firſt of men, was but a man. And the firſt principles of nature are not within our reach, when not ſubject to calculation. It is of little uſe to compute the force of the muſcles: all the mathematical rules in the world will not teach us why thoſe muſcles act at the immediate order of our will. All the knowledge we have of the planets, will never inform us why they revolve from weſt to eaſt, rather than from eaſt to weſt. Newton has anatomized light, but not diſcovered the internal nature of it. He very well knew, that there are properties in the elementary fire, not in other elements.

It traverſes 130,000,000 of leagues in a quarter of an hour. It does not appear, like other bodies, to tend towards a centre; but, contrary to the other elements, it ſpreads itſelf uniformly and equally every way. Its attraction towards the objects it touches, and from the ſurface of which it rebounds, bears no proportion to the univerſal gravitation of matter.

It is not even proved that the rays of elementary fire do not penetrate each other. Newton therefore, ſtruck with all theſe ſingularities, ſeems always to doubt whether light be a body. For my own part, ſir, if I may hazard my conjectures, I acknowledge that I do not think it impoſſible but the elementary fire may be a diſtinct being which animates nature, and fills the interval between bodies, and ſome other exiſtences we are unacquainted with; as certain organized plants lead us from the vegetable to the animal kingdom. Every thing tends to promote a belief, that there is a chain of beings gradually extended. Some links of this chain we know but imperfectly; and we little men, with our little eyes, and little brain, boldly divide all nature into matter and ſpirit, including even God himſelf; and at the ſame time know nothing of what ſpirit and matter are in reality. I lay my doubts before you, ſir, with the ſame freedom as you were pleaſed to communicate yours to me. I congratulate you on cultivating philoſophy, which ſhould teach us to doubt of every thing not to be proved by mathematics and experiment, &c.

PART III.

CHAP. I.

INTRODUCTORY IDEAS CONCERNING GRAVITY, AND THE LAWS OF ATTRACTION: THAT THE SUBTILE-MATTER, VORTICES, AND A PLENUM, OUGHT TO BE REJECTED.

Attraction. An experiment that demonſtrates a vacuum, and the effects of gravitation. Gravity acts in a ratio of the maſſes. Whence the power of gravity proceeds. Not owing to a pretending ſubtile matter. Why one body weighs more than another. The ſyſtem of Deſcartes can give no reaſon for it.

AN intelligent reader, who has conſidered with attention theſe wonderful properties of light, convinced by experience that they are not produced by any known impulſe, will doubtleſs be impatient to know more of this new power which we have ſpoken of under the name of *Attraction*, and which muſt of conſequence act more ſenſibly upon all other bodies than upon light. That we may not any more be terrified with terms, let us only examine ſimple facts.

I ſhall make uſe indifferently of the words attraction and gravitation, in ſpeaking of bodies, whether they ſenſibly tend towards one another, in immenſe orbs round one common centre, fall upon the ſurface of the earth, unite to compoſe ſolid bodies, or, laſtly, faſhion themſelves in drops to form liquids. Let us enter upon our ſubject.

All known bodies gravitate, and the notion of abſolute levity has been a long time placed among the acknowledged errors of Ariſtotle and his followers.

Since the invention of the famous air-pump we have been in a much fairer way of diſcovering the gravity of bodies; for when they fall in air, the particles of that element ſenſibly retard the central motion of thoſe bodies which have large ſurfaces and little ſubſtance; but in that machine, deprived of air, bodies being abandon'd to that force, whatever it be, which precipitates them without obſtacle, fall according to their whole weight.

The air-pump invented by Otto Guerick, was ſoon after brought to perfection by Mr. Boyle; it was furniſhed with glaſs recipients much longer than at firſt, and theſe were entirely exhauſted of air. In one of theſe tall recipients, compoſed of four tubes, the whole together being eight feet high, were ſuſpended at the top by a ſpring pieces of gold, bits of lead, ſcraps of paper, and feathers; the queſtion was to know what would be the conſequence, when the ſpring was let fly. The philoſophical gentlemen foreſaw, that the whole would reach the bottom at the ſame time: but much the greateſt number were confident, that the moſt ſolid bodies would fall with far greater velocity than the others. The multitude, which are generally in the wrong, were aſtoniſhed at the event; for in every experiment, the gold, the lead, the paper, and the feathers, deſcended equally ſwift, and came to the bottom of the recipient in one and the ſame inſtant of time.

Thoſe who ſtill maintained the plenum of *Deſcartes*, and the pretended effects of the ſubtile matter, could not give any good reaſon for this fact; for facts were the rocks on which they ſplit. If there was an abſolute plenum, tho' we allowed there might notwithſtanding be ſuch a thing as motion, (which is abſolutely impoſſible) this pretended ſubtile matter muſt at leaſt exactly fill all the recipient; it muſt be there in as great quantity as water, or mercury that might have been put there; it muſt reſiſt the pieces of paper, according to their ſurfaces, and let the gold and lead deſcend much ſooner. But this deſcent is performed in the ſame inſtant, therefore there is nothing in the recipient that reſiſts; therefore the pretended ſubtile matter cannot produce any ſenſible effect in this recipient; therefore there is ſome other power which cauſes gravity. It will be in vain to ſay, that there may poſſibly remain a ſubtile matter in the recipient, becauſe it is penetrated by the light. There is a great deal of difference in the two caſes. The light, in this glaſs veſſel, does not fill at the moſt the hundred thouſanth part of it; but according to the Carteſians, we are to imagine, that their ſubtile matter fills it much more compleatly, than if I ſuppoſed it full of gold; for there is a great deal of vacuity in gold, but they admit none in their ſubtile matter.

Now, by this experiment, the piece of gold, which weighs an hundred thouſand times as much as the paper, deſcends with the ſame velocity as the paper; therefore the power, which make it deſcend, acts an hundred thouſand times more forcibly upon the gold, than upon the paper; in like manner, as a hundred times more ſtrength is requiſite in my arm to move an hundred pounds, than to move one pound. That power then, which is the cauſe of gravity, acts in direct proportion to the quantity of matter in bodies. In effect, it acts ſo, according to the quantity of matter in bodies, and not according to their ſurfaces, that a pound of gold, reduced into duſt, will weigh preciſely as much as the ſame quantity beat out into leaves. The figure of bodies makes no alteration in their gravity; the power of gravitation then operates upon the internal nature of bodies, and not in proportion to their ſuperficies.

They can never oppoſe to theſe undoubted facts, the chimerical ſuppoſition of vortices. They ſay, that the ſubtile matter, which totally fills the recipient, is then without weight. A ſtrange idea, and here abſolutely abſurd! For it is not ſufficient in this caſe, that it is a matter without weight, but a matter without reſiſtance. All matter is reſiſted by the force of inertia. If therefore the recipient was full, the matter, whatever it be, muſt reſiſt infinitely; this is a ſtrict demonſtration.

This power does not reſide in the pretended ſubtile matter, which we ſhall conſider in the next chapter: That matter muſt be a fluid; and every fluid acts upon ſolids, in proportion to their ſuperficies. Thus a ſhip, preſenting a ſmaller ſurface at her prow, cuts through the ſea, which would reſiſt her ſides. Now, if the ſuperficies of a body be the ſquare of its diameter, the ſolidity of this body is the cube of the ſame diameter; but the ſame power cannot act at one time in proportion to the cube and the ſquare; therefore the gravity of bodies is not the effect of this fluid. Beſides, it is impoſſible, that this pretended ſubtile matter ſhould, on the one ſide, have ſo much force, as to precipitate a body from the height of fifty-four thouſand feet in a minute (for ſuch is the deſcent of bodies) and that, on the other, it ſhould be ſo weak, as not to hinder the lighteſt wooden pendulum to proceed from vibration to vibration in the air pump, which is ſuppoſed to be completely filled with this imaginary matter. I ſhall make no ſcruple then to affirm, that if any impulſe ſhould ever be diſcovered, which is truly the cauſe of the tendency of bodies towards a centre, the cauſe, in a word, of gravitation and attraction, that impulſe will be altogether of a different nature from any thing we know.

There is one primary truth then, that was pointed out elſewhere, and has here been proved, that there is a power, which occaſions all bodies to gravitate, in exact proportion to the quantity of their maſſes.

If it be actually inquired, why one body is more ponderous than another, the ſimple and only reaſon of it will eaſily be found: It will be concluded, that this body muſt have more ſolidity, more matter under the ſame ſurface. Thus gold is heavier than wood, becauſe there is in gold much more matter, and much leſs vacuity, than in wood.

Deſcartes, and his followers, maintain, that one body is heavier than another, without containing more matter. Not content with this idea, they ſupport it by another, altogether as falſe: They admit a grand vortex of ſubtile matter, encompaſſing our globe; and it is this grand vortex, they ſay, by its circulation, that impels all bodies towards the centre of the earth, and impreſſes on them that quality which we call gravity. It is true, they have not given any proof of this aſſertion. There is not the leaſt experiment, not the leaſt analogy in things, of which we have ſo little knowledge; on which we may eſtabliſh even a ſlight preſumption, in favour of this vortex of ſubtile matter; ſo that for this very reaſon alone, the ſyſtem is a mere hypotheſis, and ought to be rejected; though it was purely on this account that it obtained credit. This vortex was conceived without difficulty; an indefinite explanation of things was given, by pronouncing the words ſubtile matter; and when the philoſophers were ſenſible of the contradictions and abſurdities attending this philoſophical romance, they dreamed rather of correcting than abandoning it.

Huygens, and many others, have added a thouſand corrections, of which they themſelves confeſs the inſufficiency. But what ſhall we ſubſtitute in the place of theſe vortices, and this ſubtile matter? It was this too common way of reaſoning, more than any thing elſe, that confirmed men in the error they had embraced. But we ought to abandon what is evidently falſe and inſupportable, as well when we have nothing to ſubſtitute in its room, as when we have the demonſtrations of Euclid to ſupply in its place. An error is neither more or leſs an error, whether the loſs of it be or be not ſupplied by truth. Should I admit the horror of a vacuum in a pump, becauſe I am not yet able to judge by what mechaniſm the water riſes in that pump.

Before we proceed any farther then, let us undertake to prove, that the vortices of ſubtile matter have no exiſtence; that the idea of a plenum is equally chimerial; that therefore the whole ſyſtem, founded on theſe imaginary notions, is no more than an ingenious romance, without the appearance of truth. We will enquire firſt, what is meant by theſe vortices; and afterwards examine, whether or no a plenum be impoſſible.

CHAP.

CHAP. II.

THAT THE VORTICES OF DESCARTES AND A PLENUM ARE IMPOSSIBLE, AND CONSEQUENTLY THERE MUST BE SOME OTHER CAUSE OF GRAVITY.

Proof of the Impoſſibility of Vortices. *Proof againſt a* Plenum.

DESCARTES ſuppoſes an immenſe maſs of imperceptible particles, which carries the earth round, with a rapid motion, from weſt to eaſt, and which moves parallel to the equator from pole to pole. This vortex of matter, which extends beyond the moon, and drags her alſo along with it in its courſe, is incloſed in another vortex yet more extenſive, which touches another yet larger, without being confounded with it, and ſo on.

I.

If this were ſo, the vortex which is ſuppoſed to move round the earth from weſt to eaſt, would drive the bodies that are upon the earth, from weſt to eaſt alſo: now all bodies, in falling, deſcribe a line, which, if extended, would paſs nearly through the centre of the earth: therefore this vortex has no exiſtence.

II.

If the circles of this pretended vortex moved and acted parallel to the equator, all bodies muſt fall perpendicularly, every one under that circle of the ſubtile matter to which it anſwers: a body in A, (fig. 30.) near the pole P, muſt, according to Deſcartes, fall in

R; whereas it falls nearly in the direction of the line A B, which makes a difference of about one thouſand four hundred French leagues; for we may compute near that number from the point R, to the equator of the earth B; therefore this vortex hath no exiſtence.

III.

If, to ſupport this romance of vortices, they think proper to ſuppoſe, that the fluid of the vortex does not turn on its own axes, but to turn in the circles, whoſe centre is the ſame with the centre of the vortex; it is only neceſſary to make an experiment with a drop of oil, or a large bubble of air in a ball of cryſtal filled with water; let the ball be turned on its axis, you will ſee the oil or air form itſelf into a cylinder in the middle of the ball, and the axis extended from one pole to the other; thus every experiment, as well as every reaſon, ruins the vortices.

IV.

If this vortex of matter ſurrounding the earth, and thoſe other pretended vortices ſurrounding Jupiter, Saturn, &c. exiſted, all theſe immenſe vortices of ſubtile matter, rolling ſo rapidly in different directions, could never ſuffer any one ray of light, darted from a ſtar, to come to us in a right line. Now, it has been proved that theſe rays arrive in a very ſhort time, conſidering their immenſe diſtance; therefore no vortices exiſt.

V.

If theſe vortices carried round the planets from weſt to eaſt, the comets, which traverſe the ſpaces in all directions, from eaſt to weſt, and from north to ſouth, could not traverſe them at all. And though it ſhould be ſuppoſed, that the comets have never actually paſſed from north to ſouth, and from eaſt to weſt, yet nothing would be gained by this evaſion; for it is known, that when a comet is ſeen in the region of Mars, Jupiter, or Saturn, it moves incomparably ſwifter than Mars, Jupiter, or Saturn; therefore it cannot be carried round by the ſame bed of fluid matter which is ſuppoſed to carry round thoſe planets; therefore theſe vortices do not exiſt.

VI.

If theſe fluids exiſted, one minute would be ſufficient to deſtroy all the motions of the planets. Newton has demonſtrated, that all bodies which move in a fluid of the ſame denſity, loſe half their own motion, in travelling three of their diameters. This can never be anſwered.

VII.

Suppoſe once more, what is impoſſible, that the planets moved in theſe imaginary vortices, they would move circularly only; becauſe the vortices, at equal diſtances from the centre, muſt be equally denſe; but the planets move in ellipſes, and conſequently cannot be carried round in any ſuch vortices; therefore no ſuch vortices exiſt.

VIII.

The orbit which the earth deſcribes, is between the orbits of Venus and Mars; all theſe orbits are elliptical, and have the ſun for their centre: now, when Mars, Venus, and the earth, are neareſt one to another, the matter of this pretended torrent, which carries around the earth, muſt be much more compreſſed than at other times: this ſubtle matter ſhould then precipitate its courſe, as a river ſtraitened in its banks, or flowing under the arches of a bridge, conſequently give the earth a much greater velocity than when it is in any other poſition: but, on the contrary, the motion of the earth is then more retarded than at any other time.

When Mars appears in the ſign Piſces, (fig. 31.) that planet, the earth, and Venus, are nearly in the proximity repreſented in the figure; and then the ſun ſeems to be retarded for ſome minutes; that is, the earth is retarded: it is demonſtrably impoſſible then, that there ſhould be a torrent of matter which carries the planets; therefore the vortices have no exiſtence.

IX.

IX.

Among the more abſtracted demonſtrations, which deſtroy the exiſtence of theſe vortices, we will chuſe the following. By one of the fundamental laws of Kepler, every planet deſcribes equal areas in equal times: by another law, not leſs certain, every planet makes its revolution round the ſun in ſuch a manner, that if, for example, its mean diſtance from the ſun was ten, by taking the cube of that number, which makes a thouſand, the time of the revolution of that planet round the ſun, will be found proportionable to the ſquare root of the number one thouſand. Now, if there were torrents of matter which carried the planets, ſuch torrents could not obſerve theſe laws; for the velocity of the torrents muſt be proportional to their diſtance from the ſun, and, at the ſame time, to the ſquare roots of thoſe diſtances; which is incompatible.

X.

To ſum up the whole; all the world muſt ſee what would be the conſequence of two fluids circulating in oppoſition to one another: they would neceſſarily be confounded together, and form a chaos, inſtead of order. This alone would at once have expoſed the Carteſian ſyſtem to the utmoſt ridicule, if the love of novelty, and an habitual neglect of free and impartial examination, had not prevailed.

We are now to prove that the plenum, in which theſe vortices are ſuppoſed to move, is as impoſſible as the vortices themſelves.

1. A ſingle ray of light, which does not weigh any thing near the hundred thouſand part of a grain, muſt diſcompoſe the order of the whole univerſe, if it paſſed to us through an immenſe ſpace, every part of which would not only reſiſt of itſelf, but the whole line of matter preſſing on it.

2. Two hard bodies, A and B, (fig. 32.) touch one another in one ſurface, and are ſuppoſed to be encompaſſed with a fluid, which preſſes them on all ſides. Now, when they are ſeparated, it is clear that the

pretended ſubtile matter muſt arrive ſooner at the point A, where they divide, than at the point B. There is a moment then, wherein there muſt be a vacuum at B: therefore, even in the ſyſtem of the ſubtile matter, there is a vacuum, that is, ſpace.

3. If there was no ſuch thing as vacuum and ſpace, there could be no motion, even in the ſyſtem of Deſcartes himſelf. He ſuppoſes that God created the univerſe full, conſiſting of ſmall cubes. Let there then be a given number of cubes, repreſenting the univerſe, without their having the leaſt interval between them: it is evident that one of them muſt move out of the place it occupies; for if every one continues in its place, there can be no motion, becauſe motion conſiſts in the change of place, in moving from one point of ſpace to another. Now who does not perceive, that one of theſe cubes cannot quit its place, without leaving a vacuum at the inſtant it goes out of it; ſince it is clear that this cube, in turning itſelf round, muſt preſent its angle to the cube it touches, before that angle can be beat to pieces? At that time then there is a ſpace between theſe two cubes; therefore, even by the ſyſtem of Deſcartes himſelf,. there cannot be motion without a vacuum.

4. If all was full, as Deſcartes would have it, we ourſelves ſhould feel an infinite reſiſtance in walking; whereas we perceive no other than that of the fluids which ſurround us. That of water, for example, reſiſts 860 times, and that of mercury 14,000 times, more than that of air. Now the reſiſtances of fluids are in proportion to the ſquares of their velocities: thus if a man, in a third of time, makes his way through a foot of mercury, which reſiſts him 14,000 times more than air; if this man, in the next third, move twice as far, the mercury in this third will reſiſt in proportion to the ſquare of 2 multiplied by 14,000; a reſiſtance 56,000 times more powerful than that of air: If all was full, it would be abſolutely impoſſible to walk a ſtep, to breathe, &c.

5. The Carteſians have endeavoured to elude the force of this demonſtration; but had nothing more to oppoſe

oppoſite to the demonſtration than a manifeſt error. They pretend, that this infinite torrent of ſubtle matter, penetrating all the pores of bodies, cannot hinder their motion. They did not reflect, that every body, which moves in a fluid, feels a reſiſtance in proportion to the largeneſs of ſurface it oppoſes to that fluid. Now the more pores there are in a body, the larger its ſurface is: the pretended ſubtile matter, therefore, by choaking up all the interior parts of a body, muſt oppoſe the motion of that body much more forcibly than by touching only its outward ſuperficies; this is, therefore, an undeniable demonſtration.

6. All bodies in a plenum would be equally heavy: it is impoſſible to conceive that a body bears upon me, and preſſes me, but by its quantity of matter: a pound of gold duſt weighs as much on my hand as a lump of gold of a pound. In vain the Carteſians anſwer, that the ſubtile matter, penetrating the interſtices of bodies, has no weight, and that we ought to eſteem nothing weighty that is not ſubtile matter. This opinion, in Deſcartes, is nothing leſs than a direct contradiction; for, according to him, it is the pretended ſubtile matter alone that cauſes the gravity of bodies, by forcing them towards the earth. This ſubtile matter itſelf then gravitates upon theſe bodies; and if it doth ſo, there can be no reaſon why one body ſhould be more weighty than another; ſince all being equally full, all muſt be equal in quantity of matter, whether ſolids or fluids. A plenum, then, is a chimera; there is a vacuum; nothing can be done in nature without a vacuum; therefore gravity is not the effect of a pretended vortex in a plenum.

We muſt perceive from experiments in the air-pump, that there is a power which cauſes bodies to deſcend towards the centre of the earth, that is, which gives them their gravity, and that this power acts in proportion to their maſſes. We muſt endeavour to be convinced of the effects of that power; for if we diſcover its effects, it is evident that it exiſts. We ſhould not, however, thence imagine, that we have acceſs to the cauſe, and hypotheſes are only expedients for leading us aſtray; let us follow, ſtep by ſtep, what really paſſes in nature; we are like travellers arrived at the mouth of the ſtream, and muſt turn back before we can find the ſource.

CHAP. III.

GRAVITATION DEMONSTRATED BY THE DISCOVERIES OF NEWTON. HISTORY OF THAT DISCOVERY. THAT THE MOON REVOLVES IN HER ORBIT BY THE FORCE OF THIS GRAVITATION.

Hiſtory of the Diſcovery of Gravitation. Newton's *Proceeding thereon. Theory drawn from theſe Diſcoveries. The ſame Cauſe, by which Bodies fall to the Earth, directs the Moon round the earth.*

ALL bodies, in whatever part of the univerſe they are placed, deſcend at the rate of about fifteen feet in the firſt ſecond. We ſee that the deſcent of bodies to the earth becomes accelerated in the courſe of the fall: they all in their deſcent evidently tend towards the centre of this globe. May there not then be ſome power that attracts them towards this centre? And is not the force of this power encreaſed in proportion as it is nearer the centre? Copernicus had ſome faint notions of this power. Kepler embraced it, without method. Chancellor Bacon ſays, that it is probable there is an attraction from bodies to the centre of the earth, and from the centre to bodies. He propoſed, in his excellent book *Novum Scientiarum Organum*, that experiments ſhould be made with pendulums on the higheſt ſteeples, and in the deepeſt wells; for, ſaid he, if the vibrations of the ſame pendulums are quicker at the bottom of a well than on a ſteeple, the concluſion is, that the gravity, which is the cauſe of its vibrations, will be much ſtronger at the centre of the earth, to which this well is ſomething nearer. He alſo let fall ſeveral bodies from different elevations, obſerving whether they fell leſs than fifteen feet in the firſt ſecond; but no variation ever appeared in theſe experiments, occaſioned by the ſmallneſs of the heights and depths. Thus the point was left undetermined, and the idea of the force acting from the centre of the earth, remained a vague conjecture.

Deſcartes was acquainted with this power: he even mentions it in treating of gravity. But the experiments, by which alone this grand queſtion could be illuſtrated, were ſtill wanting. That vaſt and ſublime genius, carried away by the ſyſtem of vortices in creating his univerſe, was for giving the direction of every thing to the ſubtile matter, which he made the diſpenſer of motion and gravity. All Europe, by ſlow degrees, adopted his ſyſtem, notwithſtanding the oppoſition of Gaſſendi, who was leſs followed, becauſe leſs bold.

In the year 1666, Newton being in the country, and ſeeing ſome fruit fall from a tree (as I was informed by Mrs. Conduit, his niece) fell into a deep meditation, on the cauſe which thus draws all bodies in a line, which, if extended, would paſs nearly through the centre of the earth. What, ſaid he to himſelf, is this force, which cannot proceed from thoſe imaginary vortices, ſo often demonſtrated to be groſsly falſe? It acts on all bodies in proportion to their maſſes, and not their ſurfaces. It would act on the fruit juſt fallen from the tree, were it three, or even ten thouſand fathoms high. If ſo, this force muſt act from the orbit of the moon to the centre of the earth. If ſo, this power, whatever it be, may then be the ſame with that, by which the planets tend towards the ſun, and the ſatellites of Jupiter, gravitate on Jupiter. Now it is demonſtrated from every induction drawn from Kepler's laws, that all the ſecondary planets gravitate towards the centre of their orbits, in proportion as they are nearer to, or farther from them; that is reciprocally as the ſquares of their diſtances. Thus a body placed near the moon, which circulates round the earth, and a body placed near the earth, muſt both gravitate towards the earth, exactly according to that law.

To be aſſured, therefore, whether it be the ſame cauſe that retains the planets in their orbits, and here makes heavy bodies deſcend, a meaſure is only wanting; we need only examine the ſpace a heavy body paſſes thro' in its deſcent on the earth in a given time; and alſo what ſpace a body placed in the region of the moon, would paſs through in a given time. The moon itſelf is this body, which may be conſidered as in reality falling from its higheſt point of the meridian. But this is not an hypotheſis, accommodated at any rate to a ſyſtem. This is not a calculation, where we may acquieſce in an almoſt. We muſt begin with knowing exactly the diſtance of the moon from the earth; and, in order to know this, it is neceſſary to have a menſuration of our globe.

Thus reaſoned Newton; but with regard to the magnitude of the earth, he depended on the falſe eſtimate of navigators, who reckoned ſixty Engliſh miles, or twenty French leagues, to a degree of latitude; whereas he ſhould have reckoned ſeventy miles. There was indeed a more exact menſuration of the earth. Norwood, an Engliſh mathematician, had, in 1636, meaſured pretty exactly a degree of the meridian, and found it to contain, as it really ſhould, about ſeventy miles. Newton was a ſtranger to this operation, tho' perform'd thirty years before; for the civil wars in England, which are equally fatal to the ſciences, as to the ſtate, had buried in oblivion the only true menſuration of the globe then exiſting; and the vague reckonings of the navigators were conſidered as the ſtandard. By this calculation therefore, the moon was drawn too near the earth, and the proportion ſought by Newton did not exactly anſwer. He did not think himſelf at liberty to ſupply any defect, and accommodate nature to his ſcheme; on the contrary, he was for rendering his ſchemes conformable to nature. Thus he gave over purſuing this noble diſcovery, which the analogy with the other planets rendered ſo plauſible, and to the demonſtration of which ſo little was wanting. A rare inſtance of candor, and which alone ſhould give a great weight to his opinions.

At length, from more exact menſurations repeatedly made in France, and which we ſhall relate hereafter, he found the demonſtration of his theory. A degree of the meridian was eſtimated at twenty-five French leagues. The moon was found to be ſixty ſemi diameters from the earth; and thus Newton reſumed the thread of his demonſtrations.

Gravity on our globe is in reciprocal proportion to the ſquares of the diſtances of gravitating bodies from the centre of the earth; that is, a body weighing a hundred pounds at the diſtance of one diameter of the earth, will weigh only one pound, if the diſtance be ten diameters.

The power or force, which is the cauſe of gravity, depends not upon vortices of ſubtile matter, the exiſtence of which is demonſtrably falſe. That power, whatſoever it be, acts upon all bodies, not according to their ſurfaces, but in proportion to the quantity of their matter. If it acts at one diſtance, it muſt act at all diſtances: if it act in reciprocal proportion of the ſquares of theſe diſtances; it muſt always act according to the ſame proportion upon all known bodies, when they are not at the point of the contact, that is, let them be as near together as poſſible, without being joined. If, according to this proportion, the power of attraction, upon the ſurface of our globe, cauſes a deſcent of 54,000 Paris feet, in 60 ſeconds; a body that ſhall be diſtant from the centre of the earth about 60 of its ſemi-diameters, by the ſame rule, will fall only fifteen Paris feet in the ſame time.

The moon, in her mean motion, is diſtant about 60 ſemi-diameters of our earth, from the centre of that globe. Now, by the meaſures taken in France, we know how many feet the moon's orbit contains; we know that in her mean motion, ſhe deſcribes 187,961 Paris feet in a minute. The moon, in her mean motion, is advanced from A to B (fig. 33.) ſhe has obeyed then, both the projectile force, which directs her in the tangent A C, and the power would make her deſcend according to the line A, D, equal to B C. Take away the force which directs her from A to C, and there will remain a force which may be eſtimated by the line, C B. This line C B, is equal to the line A D: but it is demonſtrable that the curve A B, being 187,961 feet, the line A D, or C B, will be only fifteen: therefore, whether the moon falls to B, or C, it is here the ſame thing; ſhe will have deſcended 15 feet in a minute, from C to B; therefore ſhe will have deſcended 15 feet in a minute alſo from A to D. But, in deſcending this ſpace in a minute, ſhe will have travelled 3600 times as far as a moveable body upon the earth would have travelled in the ſame time: 3600 is juſt the ſquare of the diſtance; therefore the gravitation which acts upon all bodies, acts alſo between the earth and the moon preciſely in the ſame ratio of the ſquare of their diſtances.

But, if this power which animates bodies, directs the moon in her orbit, it muſt direct the earth in its orbit alſo; and the effect which it produces upon the planet of the moon, it muſt produce alſo upon the planet of the earth; for this power is every where the ſame; all the other planets muſt be ſubject to it, and even the ſun alſo muſt obey its law: and if there be no motion of the planets with regard one to another, which is not the neceſſary effect of this power, it muſt then be confeſſed, that all nature demonſtrates it: this is what we proceed to obſerve, in a more ample manner.

CHAP. IV.

THAT GRAVITATION AND ATTRACTION DIRECT ALL THE PLANETS IN THEIR ORBS.

How we ought to underſtand the Theory of Gravity, according to Deſcartes. *What is meant by the centripetal and centrifugal Forces. That Demonſtration proves that the Sun, and not the Earth, is the Centre of our Syſtem. From the preceding Reaſons it is that we have more Summer than Winter.*

ALMOST all the theory of gravity, according to Deſcartes, is founded upon this of nature, that every body which moves in a curve line endeavours to fly from its centre in a right line, which would touch the curve in a point. Such is the fling, eſcaping from the hand, &c. All bodies, in turning with the earth, endeavour thus to remove from the centre; but the ſubtile matter, ſay they, making a much greater effort, repels all other bodies.

It is eaſy to perceive, that it could not be in the ſubtile matter to make this greater effort, and to remove itſelf from the centre, or the pretended vortex, rather than other bodies: on the contrary, it would be its nature (ſuppoſing it to exiſt) to tend towards the centre of its motion, and let the bodies, which are more compact and ſolid, move to the circumference. This is in effect what happens upon a table which is made to turn round, when in a tube fixed thereon, we put ſeveral powders and liquors, of weights ſpecifically different: all the moſt ſolid and weighty bodies remove from the centre, and all the lighteſt approach it. Such is the law of nature; and when Deſcartes made his pretended ſubtile matter to circulate at the circumference of his vortex, he began by violating that law of centrifugal forces, which he had laid down as his firſt principle. It was to little purpoſe his imagining that God had created cubes turning againſt one another; that the rubbings of theſe cubes, which made his ſubtile matter, diſperſing on all ſides, acquired thereby a ſwifter motion; that the centre of a vortex incruſtated itſelf, &c. falſe imaginations were far from rectifying his error.

Without loſing more time to combat theſe imaginary beings, let us follow the mechanical laws which operate in nature. A body which moves circularly at every point of the curve which it deſcribes, takes a direction that would remove it out of the circle, by making it deſcribe a right line.

So far it is true. But care muſt be taken that this body removes from the centre, only by this other grand principle; that every body being of itſelf indifferent with regard to reſt and motion, and having that *vis inertiæ*, that ſluggiſhneſs which is an attribute of matter, follows neceſſarily the line in which it is moved. Now every body which turns round a centre, follows every moment a right line infinitely ſhort, which would become a right line infinitely long, if it met with no obſtacle. The reſult of this principle, therefore, reduced to its juſt value, is no more than this: that every body which moves in a right line, would always move in a right line, if no power acted upon it; there is another power wanting then, to make it deſcribe a curve: this other power, therefore, by which it deſcribes a curve, would make it fall every moment to the centre, in caſe the projectile motion in a right line was to ceaſe. In a word, this body would move, from moment to moment, to A, to B, to C, (fig. 34.) if freed from the latter power.

It would alſo, from moment to moment, fall from B, from C, to the centre, if the other power was wanting. The reaſon is, that its motion is compoſed of two ſorts of motions, of a projectile motion in a right line, and alſo of an imprinted motion in a right line, by the centripetal force, a force by which it would fall to the centre. Thus even from the inclination of the body to deſcribe theſe tangents, A, B, C, it is demonſtrable, that there is a force which draws it from theſe tangents, even at the inſtant they commence. It is abſolutely neceſſary then, to conſider every body that moves in a curve, as being moved by two forces; one of which is that which would make it deſcribe tangents, and which is called the centrifugal force, or rather the power of reſting or inactivity by which a body always follows a right line, if it meets with no obſtruction; the other is the force which draws the body towards the centre, which is called the centripetal, and is the true force.

From the eſtabliſhment of this centripetal force, there reſults, at firſt ſight, this demonſtration, that every body which moves in a circle, an ellipſis, or in any curve whatſoever, moves round a centre to which it tends. It alſo follows that this body, what portions of the curve ſoever it may paſs over, will always deſcribe equal areas in equal times, both in its largeſt and ſmalleſt arches. If, for inſtance, a body in one minute deſcribes the ſpace A B C, (fig. 35.) containing an hundred miles in area, it will in two minntes deſcribe the ſpace B C D, containing two hundred miles.

This law, inviolably obſerved by all the planets, and utterly unknown to antiquity, was diſcovered about 150 years ago by *Kepler*, who has merited the name of *Legiſlator* in Aſtronomy, notwithſtanding his philoſophical errors. He could not, however, diſcover the reaſon of this rule, to which all the celeſtial bodies are ſubject. The extreme ſagacity of *Kepler* diſcovered the effect, of which the genius of *Newton* has found the cauſe.

I ſhall now give the ſubſtance of Newton's demonſtration, which will eaſily be comprehended by every attentive reader: for men have a natural geometry in their minds, which makes them lay hold of propoſitions, when they are not too complicated.

Let the body A (fig. 36.) be moved to the point B, in a very ſhort ſpace of time; at the end of an equal ſpace of time, a motion, equally continued (for there is here no acceleration) would bring it to the point C: but in B it finds a force which draws it in the line B H S. It does not follow the track B H S, or the track A B C; draw the parallelogram C D B H; and then the body being moved by the two forces, paſſes along the diagonal B, D. Now this line B D and the other B A, being ſuppoſed infinitely ſhort from a curve, &c. therefore this body neceſſarily moves in a curve.

It muſt paſs over equal areas in equal times; for the area and the triangle S B A, is equal to the area of the triangle S B H: theſe triangles are equal, therefore theſe areas are equal; therefore every body which deſcribes equal areas in equal times, in a curve, makes its revolution round the centre of the forces towards which it tends; therefore the planets tend towards the ſun, turn round the ſun, and not the ſun round the earth. For, by taking the earth for the centre, their areas are found unequal in proportion to the times; and, in taking the ſun for the centre, theſe areas are always found proportional to the times; if you except only the ſmall irregularities cauſed by the gravitation of the planets themſelves.

The better to underſtand what is meant by the areas proportional to the times, and to diſcover by inſpection the advantage you may draw from this knowledge, conſider the earth as carried in its ellipſis round the ſun, S, (fig. 37.) its centre. When it paſſes from B to D, it deſcribes as large a ſpace, as when it deſcribes the great arch K K: the ſector, K K, gains in breadth what the ſector B S D, hath in length. To make the area of theſe ſectors equal in equal times, the body muſt paſs much ſwifter from H to K, than from B to D. Thus the earth, and every planet moves ſwifter in its perihelion, the neareſt point in the curve to the ſun, S, than in its aphelion, the fartheſt point of the curve from the ſame focus, S.

We know then what is the centre of a planet, and what figure it deſcribes in its orbit, by the areas it ſurrounds. We know that every planet, when it is farther from the centre of its motion, gravitates leſs towards that centre. Thus the earth being nearer the ſun by a thirtieth part, that is, by a million of leagues, during our winter than during our ſummer, is more attracted alſo in winter, and paſſes ſwifter then, by reaſon of its curve: thus we have eight days and a half more ſummer than winter, and the ſun appears in the northern ſigns eight days and a half more than in the ſouthern. Therefore ſince every planet follows, with regard to the ſun, its centre, that law of gravitation, which the moon obſerves with regard to the earth, and to which all bodies are ſubject in falling upon the earth, it is demonſtrable that this gravitation, this attraction, acts upon all bodies that are known to us.

But another powerful demonſtration of this truth, is the law that all the planets obſerve reſpectively in their courſes and diſtances. This is now what is incumbent on us to examine.

CHAP. V.

DEMONSTRATION OF THE LAWS OF GRAVITY, DRAWN FROM THE RULES OF KEPLER; THAT ONE OF THESE LAWS OF KEPLER DEMONSTRATES THE MOTION OF THE EARTH.

Great Rule of Kepler. *Falſe Reaſons of that admirable Law. True Reaſon of that Law found by* Newton. *Recapitulation of the Proofs of Gravity. Theſe Diſcoveries of* Newton *and* Kepler *ſerve to demonſtrate, that it is the Earth which revolves round the Sun. Demonſtration of the Motion of the Earth, drawn from the ſame Law.*

KEPLER diſcovered another admirable rule, of which I proceed to give an example before I define it, in order to render the thing more ſenſible and eaſy.

Jupiter has four ſatellites, which perform their revolutions round him: the neareſt is two diameters and five-ſixths diſtant from Jupiter's body, round which it moves in forty-two hours. The moſt remote makes its revolution in four hundred and two hours, I would know how far diſtant this laſt ſatellite is from the centre of Jupiter. To ſolve this queſtion, I lay down the following rule: As the ſquare of forty-two hours, the revolution of the firſt ſatellite, is to the ſquare of four hundred and two hours, the revolution of the laſt; ſo is the cube of two diameters and five-ſixths to a

fourth

fourth term. This fourth term being found, I extract its cube root, which cube root is found to be twelve two-thirds: thus I learn, that the fourth ſatellite is diſtant from the centre of Jupiter twelve and two-thirds of his diameter. I make uſe of the ſame rule for all the planets which revolve round the ſun. I ſay; Venus revolves in two hundred and twenty-four days, and the earth in three hundred and ſixty-five: the earth is thirty millions of leagues from the ſun, how many leagues them muſt Venus be? I anſwer; as the ſquare of the earth's year is to the ſquare of the year of Venus, ſo is the cube of the earth's mean diſtance to a fourth term, whoſe cube root will be about 21,700,000 leagues, the mean diſtance of Venus from the ſun. I ſay the ſame with regard to the Earth and Saturn, &c.

This law then is, that the ſquare of one revolution of any planet, is always to the ſquare of the revolutions of the other planets, as the cube of its diſtance is to the cubes of the diſtances of the others, from the common centre.

Kepler who found this proportion, was very far from finding the reaſon of it. Being leſs a good philoſopher than an admirable aſtronomer, he ſays (in his fourth book of his Epitome) that the ſun hath a ſoul, not an intelligent ſoul, *Animum*; but a *vegitative* active ſoul, *Animam*: that in turning round upon his own axis, he draws the planets to himſelf; but that the planets do not fall on the ſun, becauſe they alſo revolve upon their own axes. In making this revolution, ſays he, they preſent to the ſun ſometimes a friendly, ſometimes a hoſtile ſide; the friendly ſide is drawn, and the hoſtile ſide is repell'd; which produces the annual courſes of the planets in eclipſes.

It muſt be confeſſed, for the humiliation of philoſophy, that it was from this reaſoning, ſo very unphiloſophical, that he concluded the neceſſity of the ſun's turning round on its axis. Error accidentally conducted him to truth; he conjectured the rotation of the ſun on itſelf, above fifteen years before the eyes of Galileo diſcovered it by the help of teleſcopes.

Kepler adds (in the ſame book, p. 495) that the maſs of the ſun, the maſs of all the ether, and the maſs of the ſpheres, as the fixed ſtars, are perfectly equal; and that they are the three ſymbols of the Holy Trinity.

The reader, who, in peruſing theſe elements, has ſeen ſuch extravagant dreams, on the ſide of ſuch ſublime truths, in ſo great a man as Kepler, ſhould not be ſurpriſed: a man may be a great genius with regard to calculations and obſervations, and make a wrong uſe of his reaſon on other accounts: there are minds which have need of geometry to ſupport them, and which fall when they endeavour to proceed of themſelves. It is not ſurprizing therefore, that Kepler, in diſcovering theſe aſtronomical laws, did not find out the reaſon of theſe laws.

This reaſon is, that the centripetal force is preciſely in the reciprocal proportion of the ſquare of the diſtance from the centre of motion, towards which the forces are directed: this is what we are to obſerve attentively: In a word, we ought thoroughly to underſtand, that the law of gravitation is ſuch, that every body which approaches three times nearer to the centre of its motion, gravitates nine times more; that if it removes three times farther diſtant, it will gravitate nine times leſs; and that, if it removes to an hundred times the diſtance, it will gravitate leſs than ten thouſand times. A body moving circularly round a centre, gravitates then in the reciprocal proportion of the ſquare of its actual diſtance from the centre, as alſo in direct proportion of the quantity of its matter. It is demonſtrable then, that it is gravitation which occaſions its revolution round the centre, ſince without this gravitation, it would remove from it, by deſcribing a tangent. This gravitation, therefore, will be found to act moſt ſtrongly upon a body which revolves with moſt velocity round the centre, and the farther this body ſhall be removed, the more ſlowly will it revolve, for then it will become the leſs ponderous.

Thus have we demonſtrated this law of gravitation, in proportion to the ſquares of diſtances;

1. By the orbit which the moon deſcribes, and by her diſtance from the earth, or centre.

2. By the courſe of every planet round the ſun in an ellipſis.

3. By the compariſon of the diſtances and revolutions of all the planets round the common centre.

It will not be ſuperfluous to remark, that this rule of Kepler, which ſerves to confirm the diſcovery of Newton, concerning gravitation, confirms alſo the ſyſtem of Copernicus, concerning the motion of the earth. It may be ſaid, that Kepler, by this ſingle rule, has demonſtrated what was diſcovered before him, and opened the way to thoſe truths, which were to be diſcovered in after-time. For as on the one ſide, it is demonſtrable, that if the law of centripetal forces had no place, Kepler's rules would be impoſſible: ſo, on the other, it is demonſtrable, that, according to the ſame rule, if the ſun turned round the earth, we ought to ſay; as the revolution of the moon round the earth, is to the pretended annual revolution of the ſun round the earth, ſo is the ſquare root of the cube of the moon's diſtance from the earth, to the ſquare root of the cube of the ſun's diſtance from the earth. By this calculation it would be found, that the ſun is only 510,000 leagues from us; but it has been proved, that he is diſtant, at leaſt, about thirty millions of leagues: thus the motion of the earth then has been ſtrictly demonſtrated by Kepler. Here follows another very ſimple demonſtration, drawn from the ſame theorems.

If the earth was the centre of the ſun's motion, as it is of the moon's, the ſun's revolution would take up four hundred and ſeventy-five years, inſtead of one year: for the mean diſtance of the ſun from the earth, is to the mean diſtance of the moon from the earth, as three hundred and thirty-ſeven is to one: now the cube of the moon's diſtance is 1, and the cube of the ſun's diſtance is 38,272,753, finiſh the rule, and ſay, as the cube 1 is to this cube number 38,272,753; ſo the ſquare of 28, which is the periodical revolution of the moon, to a fourth number. You will find that the ſun would employ four hundred and ſeventy-five years in making its revolution round the earth: which demonſtrates, that it is the earth which revolves.

It ſeems the more proper to place the demonſtrations here, as there are yet men deſtined for the inſtruction of youth, in Italy, in Spain, in France, and even in England, who doubt, or who affect to doubt, of the earth's motion.

It is proved then by Kepler's law, and by that of Newton, that every planet gravitates towards the ſun, the centre of the orbits which they deſcribe: theſe laws are obſerved in the ſatellites of Jupiter, with regard to Jupiter, their centre; in the moons of Saturn, with regard to Saturn; and in our moon with regard to us: all theſe ſecondary planets, which revolve round their central planets, gravitate alſo with their central planets, towards the ſun: thus the moon, which is drawn round the earth by the centripetal force, is, at the ſame time, drawn by the ſun, round which ſhe makes her revolution. There is no variety in the moon's courſe, in her diſtances from the earth, in the figure of her orbit, ſometimes approaching to an ellipſis, ſometimes to a circle, and, which does not flow from gravitation, in proportion to her diſtance from the earth, and her diſtance from the ſun.

If ſhe does not always, in her orbit, exactly deſcribe equal areas in equal times, ſir Iſaac Newton has calculated all the caſes where this inequality muſt happen: they all depend on the attraction of the ſun, which draws theſe two globes in direct proportion of their maſſes, and in reciprocal proportion of the ſquares of their diſtances. We ſhall ſee in the next chapter, that the ſmalleſt variation of the moon, is a neceſſary effect of theſe united powers.

CHAP. VI.

NEW PROOFS OF ATTRACTION: THAT THE QUALITIES OF THE MOTION OF THE MOON, IN HER ORBIT, ARE THE NECESSARY EFFECTS OF ATTRACTION.

Proof by an Example. Inequalities in the Courſe of the Moon, all cauſed by Attraction. Deduction from theſe Truths. Gravitation is not the Effects of the Planets Courſes, but their Courſes the Effect of Gravitation. This Gravitation, this Attraction, may be a firſt Principle eſtabliſhed in Nature.

THE moon hath only one equal motion, that of rotation round herſelf on her own axis; and this is her only motion, which we cannot perceive: It is this motion that preſents us always, within a trifle, with the ſame diſk or the moon; ſo that while ſhe really turns round upon herſelf, ſhe appears not to turn at all, and to have only a ſmall motion of balancing, or libration, which ſhe has not, but which all antiquity attributed to her. All her motions round the earth are unequal, and ought to be ſo, if the rule of gravitation be true. The moon, in her monthly courſe, is neceſſarily nearer the ſun in one certain point, and at one certain time of her courſe: Now, in this point, and at this time, her quantity of matter remains the ſame: her diſtance only being changed, the attraction of the ſun ought to change in reciprocal proportion to the ſquare of this diſtance: The courſe of the moon ought then to change; ſhe ought to move ſwifter at certain times, than the attraction of the earth alone occaſions her to move: Now, by the attraction of the earth, ſhe ought to paſs over equal areas in equal times, as you have already obſerved in Chap. 14.

One cannot help admiring the ſagacity with which Newton has cleared up all theſe inequalities, and regulated the courſe of this planet, which remained till then a ſecret, notwithſtanding all the reſearches of Aſtronomers: It is upon this account eſpecially that we may ſay,

Nec proprius fas eſt mortali attingere divos.

Among the examples that may be choſen, let us take the following: Let A (fig. 38.) be the moon; A B N Q, the orbit of the moon; S the ſun, B the place of the moon, in her laſt quarter. She is now evidently at the ſame diſtance from the ſun as the earth. The difference of the obliquity of her line of direction to the ſun being diſregarded, the gravitation of the earth and of the moon towards the luminary, is apparently the ſame. The earth, however, advances in its annual courſe from T to V, and the moon in her monthly courſe advances to Z. Now, in Z, it is manifeſt that ſhe is more drawn by the ſun S, to which ſhe finds herſelf nearer than the earth. Her motion then will be accelerated from Z towards N, and the orbit that ſhe deſcribes will be changed: But how will it be changed? In being flattened a little, in approaching more to a right line from Z towards N. Thus, from moment to moment, gravitation changes the courſe and form of the ellipſis in which this planet moves. By the ſame reaſon, the moon ought to ſlacken her courſe, and to change again the figure of the orbit that ſhe deſcribes, when ſhe returns from her conjunction N, to her firſt quarter Q; for ſince from her laſt quarter ſhe accelerated her courſe by flattening the curve towards N, the conjunction; ſhe ought to ſlacken the ſame courſe, by ſwelling out the curve, in returning from her conjunction to her firſt quarter. But when the moon aſcends from this firſt quarter towards her full, A, ſhe being then farther from the ſun, is leſs attracted by it, and gravitates more towards the earth. Then the moon accelerating her motion, the curve that ſhe deſcribes is again flattened a little, as in her conjunction. And this is the only reaſon for which the moon is fartheſt from us in her quarters, than in her conjunction and oppoſition. The curve that ſhe deſcribes, is a ſpecies of oval, approaching to a circle.

Thus the ſun, to which ſhe approaches, or from which ſhe recedes at every inſtant, muſt at every inſtant vary the courſe of this planet.

She hath alſo her apogæon, and her perigæon, her greateſt and her leaſt diſtance from the earth: but the points, the places of this apogæon and perigæon, muſt neceſſarily change. She hath her nodes, that is the points, where the orbit ſhe deſcribes meets preciſely the orbit of the earth: But theſe nodes, theſe points of interſection, muſt alſo continually vary. She hath her equator, inclined to the equator of the earth: But this equator, ſometimes more and ſometimes leſs attracted, muſt likewiſe change its inclination.

She follows the earth, notwithſtanding all theſe varieties, and accompanies it in its annual courſe: But the earth, in this courſe, is found to be a million of leagues nearer the ſun in winter than in ſummer. What is the conſequence of this, independent of all theſe other variations? The attraction of the earth acts more fully upon the moon in ſummer, and then the moon finiſhes her monthly courſe a little ſooner: But, on the contrary, in the winter, the earth itſelf being more attracted by the ſun, and moving with greater velocity than in ſummer, ſuffers the motion of the moon to diminiſh, and her winter months to be a ſmall matter longer than thoſe of her ſummer. The little that we ſay of them, may ſuffice to give a general idea of theſe changes.

If any one ſhould here ſtart the difficulty, which I have heard ſometimes propoſed, why the moon, when ſhe is moſt attracted by the ſun, does not fall upon that luminary? We have only to conſider for the preſent, that the force of gravitation, which directs the moon round the earth, is only diminiſhed here by the action of the ſun.

From theſe irregularities of the lunar courſe, cauſed by attraction, you will reaſonably conclude, that no two planets, ſufficiently near, ſufficiently large, to act upon one another ſenſibly, can at any time move round the ſun in circles, or even in ellipſes, abſolutely regular. Thus the curves deſcribed by Jupiter and Saturn, for example, are ſubject to ſenſible variations, when theſe planets are in conjunction; when being the neareſt that poſſibly they can be to each other, and the fartheſt from the ſun, their mutual action augments, and that of the ſun on them diminiſhes.

This gravitation, augmented and leſſened in proportion to the diſtances, neceſſarily aſſigns an irregular elliptical figure for the path of the greateſt part of the planets. Thus the law of gravitation is not the effect of the planetary courſes, but the orbits which the planets deſcribe are the effects of gravitation. If this gravitation was not, as it really is, in reciprocal proportion of the ſquares of diſtances, the preſent order of the univerſe could not ſubſiſt.

If the ſatellites of Jupiter and Saturn make their revolution in curves, which approach nearer to a circle, it is becauſe being very near the great planets that are their centre, and very far from the ſun, the action of the ſun cannot change the courſe of the ſatellites, as it changes that of our moon. It is manifeſt then, that gravitation, the name of which alone ſeems ſuch a ſtrange paradox, is a neceſſary law in the conſtitution of the world: So true, very often, is a thing that hardly has the appearance of probability.

Let us remember here, how abſurd the opinion formerly ſeemed, that the earth was not ſpherical; and yet it has been proved, that the earth cannot have an entirely ſpherical form. The like may be ſaid concerning gravitation.

There is not at preſent any good naturaliſt, who does not acknowledge both Kepler's rule, and the neceſſity of admitting a gravitation, ſuch as *Newton* has proved: But there are yet ſome philoſophers attached to their vortices of ſubtile matter, who would willingly reconcile theſe imaginary vortices with theſe other demonſtrable truths. We have already ſeen, how far theſe vortices are from being probable: But this gravitation itſelf, does it not furniſh a freſh demonſtration againſt them? For ſuppoſing that theſe exiſted, they could not turn round a centre, by the very laws of this gravitation. We muſt have recourſe to gravitation, as the cauſe of theſe vortices, and not to the pretended vortices as the cauſe of gravitation.

If at laſt, being forced to abandon their imaginary vortices, theſe gentlemen are reduced to ſay, that this gravitation, this attraction, on ſome other cauſe, or ſome other ſecret property of matter; either that property will itſelf be the effect of ſome other property unknown, or elſe it will be a primary cauſe, a firſt principle, eſtabliſhed by the author of nature: Now, why may not the attraction of matter itſelf be this firſt principle? Newton, at the end of his Optics, ſays, it ſeems that this attraction is the effect of a ſpirit, extremely elaſtic and rare, expanded through all nature; but whence proceeds that elaſticity? Is it not alſo as difficult to comprehend as that of gravitation, attraction and the centripetal force? That force is demonſtrated; the elaſtic ſpirit is hardly ſuſpected; I will not admit a principle, which neither has, nor can be proved, for explaining a thing at once though incomprehenſible, and whoſe exiſtence all nature demonſtrates.

CHAP.

CHAP. VII.

NEW PROOFS AND NEW EFFECTS OF GRAVITATION: THAT THIS POWER IS IN EVERY PARTICLE OF MATTER: DISCOVERIES DEPENDING ON THIS PRINCIPLE.

General and important Remark on the Principle of Attraction. Gravitation and Attraction is equally in all the Particles of Matters. A bold and admirable Calculation of Newton.

WE may collect from all theſe notions, that the centripetal force, attraction, gravitation, is undoubtedly the principle of the planetary motions, of the deſcent of all bodies, and of that weight which we experience in bodies. This centripetal force, this attraction, is not, nor can be, the ſimple power of one body to draw another to itſelf. We ſhall conſider it here as a power, from which the motion round a centre reſults: This power cauſes the ſun to gravitate towards the centre of the planets, as the planets gravitate towards the ſun, and draws the earth towards the moon, as well as the moon towards the earth. One of the primitive laws of motion is yet a fuller demonſtration of this truth. This law is, that action and re-action are equal: Thus, if the ſun gravitates on the planets, the planets gravitate on the ſun; and we ſhall ſee at the beginning of the following chapter, in what manner this great law operates. Now this gravitation, acting neceſſarily in direct proportion of the quantity of matter; and the ſun being about 760 times as large as all the planets put together (without reckoning the ſatellites of Jupiter, and the ring and moons of Saturn) it follows that the ſun muſt be their centre of gravitation, and conſequently, that they muſt revolve round that luminary.

Let us carefully remark, that, when we ſay, the power of gravitation acts *in direct proportion of the quantities of* matter, we always underſtand that this power of gravitation act ſo much the more ſtrongly on a body, as this body has a greater number of particles; and we have demonſtrated this, in ſhewing that a ſtraw deſcends as ſwiftly in an exhauſted recipient, as a pound of gold. We have ſaid (making allowance only for the ſmall reſiſtance of the air) that a leaden ball, for example, falls fifteen feet in one ſecond, near the ſurface of the earth: We have demonſtrated, that this ſame ball would fall only fifteen feet in a minute, if it was removed as far as the moon is from the earth; that is, ſixty of the earth's ſemidiameters: Therefore the power of the earth upon the moon, is to the power that it would have upon a leaden ball elevated to the moon, as the ſolid body of the moon would be to the ſolid body of this ball. It is in this proportion that the ſun acts upon all the planets; he draws Jupiter and Saturn in a direct ratio of the quantity of ſolid matter, that is in the ſatellites of Jupiter and Saturn, and of that in Jupiter and Saturn.

From hence flows an inconteſtible truth; that this gravitation is not only in the whole maſs of every planet, but in every particle of that maſs; and that there is not an atom of matter in the univerſe, but what is affected with this property.

From among the methods in which Newton has demonſtrated, that gravitation is equal in every atom, we will chuſe here the moſt ſimple. If all parts of a globe had not equally this property, if there were ſome weaker and ſome ſtronger particles, a planet, in turning upon its own axis, would neceſſarily preſent ſometimes weaker and ſometimes ſtronger ſides at the ſame diſtance. Thus the ſame bodies, on all poſſible occaſions, would experience at an equal diſtance, ſometimes one degree of gravitation, ſometimes another. The law of reciprocal proportion of the ſquares of diſtances, and the law of Kepler would be always inverted, or proved not to ſubſiſt. Therefore there is not, in all the planets, any one particle of matter that gravitates more than another. Here follows another demonſtration. If there were bodies in which this property was different, ſome bodies would fall more ſlowly, others more ſwiftly, in the exhauſted air-pump. But all bodies fall in the ſame time; and all pendulums of an equal length, whether of gold, of ſilver, of iron, of maplewood, or of glaſs, make equal vibrations in the air in equal times: therefore all bodies have this property of gravitation preciſely in the ſame degree, that is, preciſely in proportion to their maſs; ſo that gravitation acts as a hundred upon a hundred atoms, and as ten upon ten atoms.

From truth to truth the human mind riſes inſenſibly to ſuch ſublime points of knowledge, as ſeem to be entirely beyond the ſphere of human perſpicuity. Newton has ventured, by the help only of the laws of gravitation, to calculate what muſt be the weight of bodies on other globes, beſides that we inhabit; what the ſame body, for inſtance, which we here call a pound, muſt weigh in the moon, in Saturn, in the ſun: And as theſe different weights depend directly on the quantity of matter in theſe globes, it was neceſſary to calculate what that quantity is. Let it not be ſaid, after this, that gravitation, that attraction, is an occult quality: Let not any one dare to call by this name, an univerſal law, which leads to ſuch aſtoniſhing diſcoveries!

CHAP. VIII.

Theory of our Planetary System.

Demonſtration of the Earth's Motion round the Sun, drawn from Gravitation. Magnitude of the Sun. He turns on his own axis round the common centre of the planetary Syſtem. He continually changes Place. His Denſity. In what Proportion Bodies deſcend to the Sun. Newton's *Thoughts concerning the Denſity of Mercury. Prediction of* Copernicus *with regard to the Phaſes of Venus.*

The Sun.

THE ſun is the centre of our planetary ſyſtem, and ought neceſſarily to be there. We do not mean by this, that the middle point of the ſun is preciſely the centre of the ſyſtem; but that the central point towards which our ſyſtem gravitates, is neceſſarily in the body of that luminary, and all planets, having once received their projectile motion, muſt continually turn round this point, which is in the ſun. We prove it thus.

Let the greater of theſe two globes, A, and B, (fig. 39.) repreſent the ſun, and the leſſer, any planet whatſoever. If they are both abandoned to the law of gravitation, and free from all other motion, they will be attracted in direct proportion of their quantity of matter; they will be determined towards one another in a ſtrait line; and A, being a million of times larger than B, will force B to move towards I, a million of times faſter than A will move towards B. But let them both have a projectile motion in proportion

portion to their maſſes, the planet in the line B C, the ſun in the line A D, and then the planet is impelled by two forces; it tends in the line B C, and gravitates at the ſame time towards the ſun in the line A B; it will therefore deſcribe the curve B F, and the ſun, in like manner, will follow the line A E; and both gravitating towards each other, will turn round a common centre: but the ſun ſurpaſſing the earth in magnitude a million of times, and the curve A E, which he will deſcribe, being a million of times leſs than that which the earth deſcribes, this common centre is neceſſarily near the middle of the ſun.

It is alſo here again demonſtrated, that the earth and the planets turn round this luminary: and this demonſtration is by ſo much the more beautiful and ſtrong, as it is entirely independent on obſervation, and founded upon the primordial mechaniſm of the ſyſtem.

If we make the diameter of the ſun equal to 100 diameters of the earth; and if conſequently the ſun ſurpaſſes the earth a million of times in magnitude, it will follow, he is 700 times larger than all the planets together, excepting the ſatellites of Jupiter and Saturn, and Saturn's ring. He gravitates towards the planets, and the planets alſo gravitate towards him; it is this gravitation that makes them circulate, by drawing them from a tangent; and the attraction which the ſun exerciſes upon them, ſurpaſſes that which they exerciſe upon him, as much as he ſurpaſſes them in quantity of matter. Never loſe ſight of this truth, that reciprocal attraction is nothing but the law of moveable bodies, all gravitating, and all turning round one common centre.

The ſun then turns round this common centre, that is, upon his own axis, in twenty-five days and an half. His middle point is always a little diſtant from this common centre of gravity, and his body removes from it in proportion as ſeveral planets in conjunction attracted him towards them: but if all the planets were on one ſide, and the ſun on the other, the common centre of gravity would hardly be out of the ſun's body; their united forces being ſcarcely ſufficient to diſorder and remove the ſun one intire diameter. He really changes place then every moment, according as he is more or leſs attracted by the planets; and this little approach of the ſun re-eſtabliſhes that diſorder which the planets operate on one another: thus the continual irregularity of this luminary preſerves the order of nature.

Though he ſurpaſſes the earth in manitude a million of times, he does not contain a million of times more matter, as was before obſerved. If he was actually a million of times more ſolid, more compact than the earth, the order of the ſyſtem would not be what it now is: for the revolutions of the planets, and their diſtances from their centre, depend on their gravitation, and their gravity is in direct proportion of the quantity of matter in the globe, which is their centre: therefore, if the ſun ſurpaſſed our earth and our moon in ſolid matter, to ſuch a great exceſs, the planets would be much more attracted, and their ellipſes much leſs regular, than they are at preſent.

In the ſecond place, the matter of the ſun cannot be in proportion to his magnitude; for his globe being all on fire, its rarefaction is neceſſarily very great, and the matter leſs in proportion as the rarefaction is greater. By the laws of gravitation it appears, that the ſun contains but 250,000 times as much matter as the earth: now the ſun, a million of times larger, being but the fourth part of a million more material than the earth; the earth, a million of times leſs, has, in proportion, four times as much matter as the ſun, and is four times as denſe.

The ſame body, according to this computation, which weighs a pound upon the ſurface of the earth, would weigh twenty-five pounds upon the ſurface of the ſun: but the true proportion is only of twenty-four to one; becauſe the earth is not in effect four times as denſe as the ſun, and becauſe the diameter of the ſun ſurpaſſes that of the earth only ninety-five times and an half. The ſame body which deſcends here fifteen feet in the firſt ſecond, would deſcend about three hundred and fifty feet upon the ſurface of the ſun, all other things being equal.

The ſun loſes daily, according to Newton, a little of his ſubſtance, and would be, in the revolution of many ages, reduced to nothing, if the comets, which from time to time impinge on his ſphere, did not ſerve to repair his loſſes; for every thing in the univerſe alters and is repaired.

MERCURY.

From the ſun to the diſtance of eleven or twelve millions of leagues, or thereabouts, there does not appear any globe. At eleven or twelve millions of leagues from the ſun is Mercury, in his mean diſtance. This is the moſt excentric of all the planets; he moves in an ellipſis, which places him in his perihelion almoſt a third nearer the ſun than in his aphelion.

Mercury is almoſt twenty-ſeven times leſs than the earth: he turns round the ſun in eighty-eight days, which conſtitute his year.

His revolution upon his own axis, which forms his day, is unknown; nor can either his weight or his denſity be aſcertained. We only know, that if Mercury be an earth exactly like ours, the matter of its globe muſt be about eight times more denſe than ours; otherwiſe, every thing there would be in ſuch a degree of efferveſcence, as would deſtroy animals of our ſpecies in an inſtant, and cauſe all matter of the conſiſtence of the waters on our globe to evaporate.

The following is a proof this aſſertion. Mercury receives about ſeven times more light than we, in proportion to the ſquare of the diſtances, becauſe it ſeems about 2¾ times nearer the centre of light and heat; it is therefore ſeven times more ſultry, all things being equal. Now, upon our earth, the great heat of a ſummer being augmented ſeven or eight times, makes the water boil immediately in large bubbles:

therefore it is neceſſary that every thing ſhould be about ſeven times more denſe than it is, to reſiſt ſeven or eight times as much heat as the moſt ſcorching ſummer produces in our climates: therefore Mercury ought to be at leaſt ſeven times more denſe than our earth, to make it poſſible for the ſame things as ſubſiſt on our earth to ſubſiſt on the globe of Mercury, all things being equal. In fine, if Mercury receives about ſeven times more rays than our globe, becauſe it is about $2\frac{2}{3}$ times nearer the ſun; by parity of reaſon, the ſun appears in Mercury ſeven times larger than on our earth.

VENUS.

After Mercury is Venus, at between twenty-one and twenty two millons of leagues from the ſun in its mean diſtance: it is as large as the earth, and its year conſiſts of two hundred and twenty-four days. We do not yet know the length of its day, that is, of its revolution on its own axis. Very great aſtronomers believe the day in Venus to be only twenty-four hours; others lengthen it to twenty-five of our days. There have not hitherto been made any obſervations, ſufficiently certain to ſhew on which ſide the error lies; but this error, wherever it be, can be only a miſtake of the eyes, an error of obſervation, and not of judgment.

The ellipſis, which Venus deſcribes in its year, is leſs eccentric than that of Mercury: (fig. 40.) Some idea of the paths of theſe two planets round the ſun, may be formed from the figure.

It is not foreign to our purpoſe to remark here, that Venus and Mercury have different phaſes with regard to us, as well as the moon. Copernicus was formerly told, that theſe phaſes ought to appear in his ſyſtem; which it was concluded was falſe, becauſe no ſuch phaſes could be perceived. If Venus and Mercury, ſaid his antagoniſts, turn round the ſun, and we turn in a greater circle, we ought to ſee Venus and Mercury ſometimes full, ſometimes encreaſing, &c. but this is what we have never ſeen. It is nevertheleſs what really happens, anſwered Coperncius, and what you will ſee hereafter, if ever you find means to render your ſight ſufficiently perfect. The invention of teleſcopes, and the obſervations of Galileo, conſpired, ſoon after, to accompliſh the prediction of Copernicus. As to other particulars, nothing certain can be ſaid concerning the quantity of matter in Venus, or the weight of bodies on that planet.

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CHAP. IX.

THEORY OF THE EARTH.

Examination of its Figure.

I Shall treat more fully of the theory of the earth, and firſt examine its figure, which neceſſarily reſults from the laws of attraction, and its rotation round its own axis. I ſhall ſhew its motions, and conclude this theory of our globe, with the moſt evident proofs of the cauſe of the tides; a phænomenon, till Newton, inexplicable, and now the nobleſt proof of the truths taught by that great mathematician. I begin with the figure of our globe.

OF THE FIGURE OF THE EARTH.

Hiſtory of the Opinions with regard to the Figure of the Earth. Richer's *Diſcovery, and its Conſequences.*— Huyghens's *Theory.* Newton's *Theory. Diſputes in* France *concerning the Figure of the Earth.*

THE firſt aſtronomers in Aſia and Egypt ſoon perceived, by the projection of the earth's ſhadow in lunar eclipſes, that the earth is round; the

Hebrews, who were wretched philoſophers, imagined it to be flat: with them, the ſky was a ſemivault covering the earth, whoſe figure or extent they knew nothing of; but hoped ſome time or other to get the whole of it into their power. This conceit, of the earth being of ſmall extent, prevailed a long time among the chriſtians; many doctors of the fifteenth century made no queſtion but that the earth was flat and long from eaſt to weſt, and very narrow from north to ſouth. A biſhop of Avila, who wrote at that time, conſiders the contrary opinion as a hereſy and an abſurdity: at length reaſon and the voyages of Columbus reſtored the ſpherical figure of the earth. Then the learned world ran from one extreme to the other; the earth was conceived to be a perfect ſphere, as afterwards it was believed that the planets performed their revolutions in a true circle. But when it came to be well known that our globe turns round on its axis in twenty-four hours, this alone was a ſufficient indication that its figure could not be perfectly round. Not only the centrifugal force raiſes the waters conſiderably in the region of the equator, by the motion of the rotation in twenty-four hours; but by the tides, they are alſo raiſed there, twice a day, to the height of about twenty-five feet; thus the countries about the equator would be perpetually under water; but they are not; the region of the equator then, is, in proportion, much higher than the reſt of the earth; the earth then is a ſpheroid raiſed at the equator, and cannot be a perfect ſphere. This proof, ſo eaſily diſcovered, had eſcaped the greateſt geniuſes; ſuch an enemy to inveſtigation is univerſal prejudice.

Every one knows that Richer in a voyage to la Cayenne, near the equator, undertaken in 1672 by order of Lewis XIV. under the auſpices of Colbert, that liberal father of all the arts and ſciences, Richer, I ſay, among many obſervations, found that the vibrations or oſcillations of the pendulum of his clock to be ſlower than in the latitude of Paris, and that it was abſolutely neceſſary to ſhorten the pendulum a line and ſomething above a quarter. Natural philoſophy and geometry were not, at that time, arrived to the preſent degree of perfection: who could have thought that this obſervation, apparently ſo inſignificant, that a line more or leſs ſhould be the cauſe of diſcovering the moſt noble phyſical truths? It appeared immediately, that gravity muſt be leſs at the equator than in our latitude, it being gravity alone which cauſes a pendulum to oſcillate, conſequently, the weight of bodies decreaſing, the more diſtant theſe bodies are from the centre of the earth, the region of the equator muſt be elevated conſiderably above ours, and therefore more diſtant from the centre; thus the earth could not be a perfect ſphere. Theſe diſcoveries induced many philoſophers to act as men do when they are about changing their opinions. Richer's experiment was canvaſſed; it was aſſerted, that if the vibrations of pendulums were ſlower near the equator than with us, it was owing to the rod being lengthened by the heat; but it appeared that the heat of the hotteſt ſummer lengthens it only a line in thirty feet; whereas here was a line and a quarter, a line and an half, and even two lines, in an iron rod not above three feet eight lines in length.

Some years after, Meſſ. Varin, Deſhays, Feuillée, and Couplet, repeated, near the equator, the ſame experiments of the pendulum; and all ſhewed that it muſt be ſhortened, tho' very often the heat under the line was leſs than at fifteen or twenty degrees from the equator. This experiment has been farther confirmed by the academicians ſent by Lewis XV. to Peru, who in the neighbourhood of Quito, on mountains where it froze, were obliged to ſhorten their ſecond-pendulum near two lines *.

Nearly about that time, the academicians who went to meaſure an arch of the meridian in the north, found that at Pello, beyond the polar circle, it was neceſſary to lengthen the pendulum, to render it equal to thoſe at Paris. Gravity is therefore greater at the poplar circle than in France, as it is greater in the latter

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* This was written in 1736.

latter than at the equator. If gravity be greater in the north, the north is nearer the centre than the equator; the earth therefore is flattened towards the poles.

Never was there a more perfect agreement between experience and reaſon in proof of a truth. The famous Huyghens, by calculating the centrifugal forces, had proved, that gravity muſt be leſs at the equator than at the poles, and conſequently the earth muſt be a ſpheroid flattened at the poles. Newton, by the principles of attraction, had drawn nearly the ſame concluſions; it muſt only be remarked, that Huyghens believed this an inherent force in bodies, determining them to the centre of the globe; but this primitive gravity to be every-where alike. He was then ſo great a ſtranger to Newton's diſcoveries, that he conſidered the decreaſe of gravity only by the theory of centrifugal forces; and the primitive gravity under the equator, as diminiſhed by the effect of the centrifugal forces. The ſmaller the circles become in which this centrifugal force acts, the more this force yields to that of gravity: thus, under the very pole, there being no centrifugal force, primitive gravity is in poſſeſſion of its whole action. But this principle of a gravity every where equal, is exploded by Newton's diſcovery, which we have already explained; that a body removed, for inſtance, to ten diameters from the centre of the earth, weighs a hundred times leſs than at one diameter.

It is therefore by the laws of gravitation, combined with thoſe of the centrifugal force, that the figure of the earth is truly and clearly exhibited; and of this theory Newton and Gregory were ſo certain, as to make no difficulty of advancing, that the experiments on gravity ſhewed the figure of the earth with more certainty than any geographical menſuration.

Lewis XIV. had ſignalized his reign by that meridian which traverſes France. The famous Caſſini, aſſiſted by his ſon, had, in 1701, drawn from the foot of the Pyrenees, to the obſervatory, a line as ſtraight as poſſible, thro' almoſt unſurmountable obſtacles, which the heights of mountains, the variation of refraction in the air, and the diſorders to which inſtruments are expoſed, were continually throwing in the way of this grand and critical enterprize. During that year he meaſured ſix degrees eighteen minutes of this meridian. But to whatever cauſe the error was owing, he found the degrees towards Paris, that is, towards the north, ſhorter than thoſe towards the Pyrenees, or ſouth. This menſuration contradicted both that of Norwood, and the new theory of the earth's being flattened towards the poles. This new theory, however, was ſo generally admitted, that the ſecretary of the academy, in his hiſtory of 1701, made no ſcruple of ſaying, that the new menſurations taken in France, proved the earth to be an oblate ſpheroid. Caſſini's menſurations indeed produced a concluſion directly oppoſite: but the figure of the earth, not being as yet a queſtion in France, this falſe concluſion paſſed unnoticed. The degrees of the meridian from Collioure to Paris, were conſidered as exactly meaſured, and the earth at the pole, though by theſe menſurations neceſſarily lengthened, was conſidered as flattened.

M. de Roubais, an engineer, amazed at the concluſion, demonſtrated that by the menſurations taken in France, the earth muſt be an oblong or prolate ſpheroid, of which the meridian from one pole to the other is longer than the equator, and the earth lengthened at the poles. But of all the philoſophers, to whom he has inſcribed his diſſertation, not one would conſent to the printing it; the academy having, as they imagined, pronounced abſolutely, and an appeal ſeemed too bold in a private perſon. Some time after the error committed in 1701 was perceived, a retraction was made, and by a juſt concluſion drawn from a falſe principle, the earth was lengthened at the poles. The meridian was now continued from Paris to Dunkirk; and ſtill the degrees were found to ſhorten, in proceeding towards the north. About this time, ſome mathematicians, engaged in the like experiments in China, were amazed to find any difference between the lengths of their degrees, which

they

they thought muſt be all equal; and, after repeated attempts, to find them ſhorter towards the north, than towards the ſouth. This agreement between the mathematicians of France and thoſe of China, was a ſtrong proof of the earth's being an oblong ſpheroid. This was not all, parallels to the equator were meaſured in France. It is eaſily conceived that on an oblong ſpheriod, our degrees of longitude muſt be ſmaller than on a ſphere. The parallel paſſing through St. Malo, M. Caſſini found 1037 toiſes ſhorter than it ought to have been, if the earth had been a ſphere. This degree was therefore incomparably ſhorter than it would have been on an oblate ſpheroid.

All theſe erroneous menſurations proved that the degrees were as they wiſhed to find them; the demonſtrations of Newton and Huygens, were, for a time, exploded in France, and no queſtion was made, but the earth was of a figure quite oppoſite to that of the former opinion.

At length the new academicians, who went to the polar circle in 1736, having, by other menſurations, found a degree in thoſe climates to be much longer than in France, it created a doubt between them and Caſſini; but this doubt was ſoon after removed; for the ſame gentlemen, at their return from the polar circle, again examined the degree meaſured by Picard, in 1677, to the northward of Paris, and found it one hundred and twenty-three toiſes longer than Picard had made it. If therefore Picard, with all his precautions, had made his degree one hundred and twenty-three toiſes too ſhort; there was great reaſon to ſuſpect, that the degrees towards the ſouth would afterwards be found longer than they ſhould be. Thus Picard's firſt error, as it had been the foundation of the menſurations of the meridian, ſerved alſo as an excuſe for the almoſt unavoidable errors, which very good aſtronomers might have committed in that arduous undertaking: the academicians, now returned from the north, had on their ſide both theory and practice in this diſpute; and both were confirmed by an acknowledgment, made to the academy in 1740, by the famous Caſſini's grandſon, who poſſeſſed all the merits of his father and grandfather; and who had juſt finiſhed his menſuration of a parallel to the equator. He owned that this menſuration, which had been made with all the attention the diſpute required, proved the earth flattened at the pole. This magnanimous acknowledgment ſhould terminate the diſpute to the honour of all parties. The difference of ſo many meaſurements ſhews how eaſily we may be miſtaken. The thickneſs of a hair on our planet, anſwers in the heavens to millions of leagues. Newton was much better aſſured of the oblate figure of the earth, by his demonſtrations, than it is poſſible to be of the degree of that flattening, by the beſt inſtruments.

The difference between the ſphere and ſpheroid does not cauſe a greater or leſſer circumference; for the ſuperficies of a circle, changed into an oval, is neither enlarged nor diminiſhed, as the difference between the two diameters is not above ſeven leagues; an immenſe difference to diſputants, but inſenſible to thoſe, who, in their menſurations of the terreſtial globe, conſider only the utility reſulting from their performance. There is not a geographer who could in a map render this difference perceivable, nor a navigator, who could ever know whether he ſailed on a ſpheroid, or on a ſphere. But the difference between the menſurations which made the ſpheroid prolate, and thoſe which made it oblate, was little ſhort of a hundred leagues, and therefore affected navigation.

CHAP. X.

OF THE PERIOD OF TWENTY-FIVE THOUSAND NINE HUNDRED AND TWENTY YEARS, CAUSED BY ATTRACTION.

General Miſtake in the Language of Aſtronomy. Hiſtory of the Diſcovery of this Period. Not favourable to Newton's *chronology. Explication of it by the* Greeks. *Inquiries into the Cauſe of this Period.*

IF the figure of the earth be an effect of gravitation or attraction, this powerful principle of nature is alſo the cauſe of all the motions of the earth, in its annual courſe. In this courſe it has a motion, the period of which is completed in about twenty-ſix thouſand years; this period is termed the preceſſion of the equinoxes; but to explain this motion and its cauſe, we muſt take a retroſpective view of things.

The common language, with regard to aſtronomy, is one perpetual oppoſition to truth. The planets are ſaid to perform their revolutions on the equator, that the ſun, like them, daily revolves round the earth from eaſt to weſt; while the planets, by another motion oppoſite to the ſun, turn ſlowly from weſt to eaſt; that the planets are ſtationary and retrograde. Nothing of which is true; it is known that the cauſe of all theſe phænomena is the motion of the earth. But we continue to expreſs ourſelves as if the earth was immoveable, and the common language is retained, as the language of truth would be too contradictory to our eyes, and to the conſtant prejudices, ſtill more deceptive than ſight.

But aſtronomers never ſpeak in a manner leſs conſonant to truth, than when, in their almanacs, they ſay, *the ſun enters the ſpring in ſuch a degree of Aries*; *ſummer begins with the ſign of Cancer*; *and autumn with Libra*. Theſe ſigns have long had new places in the heavens relatively to our ſeaſons; and therefore, it is high time to alter the way of ſpeaking, and one day we muſt: for, in reality, our ſpring begins when the ſun riſes with Taurus, our ſummer with Leo, our autumn with Scorpio, our winter with Aquarius; or to ſpeak more accurately, our ſeaſons begin when the earth, in its annual courſe, is in the ſigns oppoſite to thoſe which riſe with the ſun.

Hipparchus was the firſt among the Greeks, who perceived the ſun not to riſe at the beginning of ſpring in the ſame ſigns as formerly; this aſtronomer lived about ſixty years before our common æra. The lateneſs of ſuch a diſcovery, which ought to have been made much ſooner, proves the Greeks were no proficients in aſtronomy. It is thought (but it is only one author in the ſecond century who ſays ſo) that at the time of the expedition of the Argonauts, Chiron, the aſtronomer, fixed the beginning of ſpring, i. e. the point where the ecliptic of the earth cut the equator, in the fifteenth degree of Aries. It is a certain fact, that above five hundred years after, Meton and Euctemon obſerved, the ſun at the beginning of ſummer, to enter the eighth degree of Cancer, and conſequently the vernal equinox was no longer in the fifteenth degree of Aries, the ſun had advanced ſeven degrees eaſtward ſince the Argonautic expedition. On theſe obſervations of Meton and Euctemon, made five hundred years after that expedition, and a year before the Peloponneſian war, Newton has in part founded his ſyſtem for the amendment of chronology; and concerning which I cannot forbear ſubmitting my ſcruples to the judgment of the learned.

Had Meton and Euctemon found ſuch a palpable difference as ſeven degrees, between the ſun's place in Chiron's and their time, I think, they muſt have diſcovered this preceſſion of the equinoxes, and the period reſulting from it. A ſimple rule of three would have done it; it was only ſaying; If the ſun advances about ſeven degrees in a little above five hundred years, in how many years will he finiſh the whole circle? There was the period ready found. Yet nothing of it was known till Hipparchus's time; which ſilence induces me to ſuſpect, that Chiron is ſaid to have known more of it than he really did; and that it was not till afterwards, that he was thought to have fixed the vernal equinox at the fifteenth degree of Aries. It was imagined he had done it, becauſe he ſhould have done it. Ptolemy does not ſay a word of it in his Almageſtus; and this conſideration appears in my opinion to affect Newton's chronology.

It was not from Chiron's obſervations, but by thoſe of Ariſtillus and Meton, compared with his own, that Hipparchus began to have ſome ſuſpicion of a new viciſſitude in the courſe of the ſun. Ptolemy, about two hundred years after Hipparchus, aſcertained the fact, though in a confuſed manner. This revolution was thought to be a degree in a hundred years; and it is from this falſe calculation, that the great year of the world was made to conſiſt of thirty-ſix thouſand years; whereas this motion is truly but a degree, or thereabouts, in ſeventy-two years; and according to the moſt received computations, the period is only twenty-five thouſand, nine hundred and twenty years. The Greeks, who were not acquainted with the antient Aſiatic ſyſtem, revived by Copernicus, had no thought of this period's having any relation to the earth. They imagined a chimerical *primum mobile*, by which all the ſtars, the planets and the ſun, were, in twenty-four hours, carried round the earth; then a cryſtalline heaven, which, in thirty-ſix thouſand years, ſlowly turned from weſt to eaſt, and which, I know not how, made the ſtars to move in a retrograde order, contrary to their primum mobile; all the other planets, and the ſun itſelf, performed their annual revolution, each in its cryſtalline heaven; and this was called philoſophy. At length, in the laſt century, it came to be known, that this preceſſion of the equinoxes, this long period, proceeded wholly from a motion of the earth, whoſe equator, from year to year, cuts the ecliptic in different points, as ſhall be now explained.

But before I prove the motion, and ſhew the cauſe of it, may I farther be allowed to inquire what might be the reaſon of this period?

Whatever preſumption there may be in determining the creator's reaſons, yet to ſay that we have gueſſed the utility of the other motions of our globe, is at leaſt conſidered as excuſable.

If from year to year, in its great orbit, it travels at leaſt about a hundred and ninety eight millions of leagues round the ſun, it is to this courſe we owe the ſeaſons. If it turns on its own axis in twenty-four hours, the diſtribution of days and nights is probably one of the creator's ends in this rotation. There appears to me another neceſſary reaſon of this daily motion, which is, that, without this revolution on itſelf, the earth would have no centrifugal force, all its parts being compreſſed towards the centre, by the centripetal force, would become an unſurmountable adheſive maſs, the conſequence of which muſt be a total ſterility.

In a word, we raſhly conceive the uſefulneſs and benefit of all the motions of the earth; but for this motion of the pole in twenty-five thouſand nine hundred and twenty years, it has no evident utility. By this motion, our preſent polar ſtar, will, one day, be no longer ſuch, and it is proved not to have been ever there; the equinoxes, and the ſolſtices alter; the ſun, whatever all the almanacs ſay, is no longer in Aries at our ſpring-equinox, it is in Taurus, and in proceſs of time will be in Aquarius: And what of all this? No new ſeaſons, no new diſtribution of heat and light are produced by this change; every thing in nature continues the ſame. Whence then this period of twenty-five thouſand nine hundred and twenty years, ſo long, and at the ſame time, in appearance ſo uſeleſs ?

In all the compound machines we are acquainted with, there is ever ſome effect, not of itſelf producing the benefit derived from the machine, but is a neceſſary conſequence of its conſtruction ; for inſtance, in a water-mill, a great deal of the water falling on the floats is ſcattered, on all ſides, by the motion of the wheel ; this water is of no uſe to the machine, but is an indiſpenſable effect of the wheel's motion. The noiſe of a hammer hath nothing in common with the body faſhioned on the anvil by the hammer, yet the vibration of the anvil muſt neceſſarily accompany that action. The vapour exhaling from a boiling liquor, neceſſarily comes from it, without contributing in the leaſt to the uſe we make of that liquor : and he who believes theſe effects to be neceſſary, though often of no ſenſible utility, forms a true judgment of them.

If we may for a moment compare the works of God with thoſe of our defective art, it may be ſaid, that in this immenſe machine, he has ſo diſpoſed or arranged things, that many defects follow indiſpenſably, though without being of any advantage to us. This ſeems to be entirely the caſe of this period of twenty-five thouſand nine hundred and twenty years : it is a neceſſary effect of the ſun and moon.

In order to form a clear idea of this periodical motion of twenty-five thouſand nine hundred and twenty years, we are firſt to imagine the earth (fig. 41.) carried annually round the ſun on its axis, A B, parallel to itſelf. This axis moving from weſt to eaſt, ſeems always directed towards the pole-ſtar ; the earth in the mid-way of its annual courſe, that is, if the reader pleaſes, from ſpring to autumn, has travelled about 98,000,000 of leagues ; a ſpace, which, however large, is nothing when compared to the extreme diſtance of this ſtar, which it would always equally behold, if the axis of the earth was always in the ſame direction, A B, as you now ſee it. But this axis does not always keep this poſition ; and after a great number of years, this axis, imagined in the line of the ecliptic, will be no longer in the ſituation A B. It no longer obſerves its motion of paralleliſm; is no longer directed towards this polar ſtar. This different direction is hardly any thing with regard to the immenſe extent of the heavens, but is very conſiderable with regard to the motion of our pole.

Imagine, therefore, this little globe of the earth performing its very little revolution of about 198,000,000 of leagues, which is no more than a point in the immenſity of the ſtarry expanſe; its pole, which anſwers to this polar ſtar at P (fig. 42.) will, at the end of ſeventy-two years, be removed a degree. In ſix thouſand five hundred years, this pole will point towards the ſtar T; and after about thirteen thouſand years will anſwer to the ſtar Z. Our axis will ſucceſſively move from Z to F, and return to P; ſo that at the expiration of twenty-five thouſand nine hundred years, or thereabouts, we ſhall have the ſame polar ſtar as at preſent.

After giving a figure of this revolution of our axis, the phyſical reaſon of it will be eaſily known. Let us remember, that Newton, ſpeaking of the inequalities in the motion of the moon, has demonſtrated that they all depend on the attraction of the ſun and earth combined together. It is this attraction, this gravitation, which continually changes the poſition of the moon, as we have already ſeen in Chap. VI. And, reciprocally, the attraction of the ſun and that of the moon, acting on the earth, continually change the poſition of our globe. Let us remember, that the earth is much higher at the equator than towards the poles. Imagine the earth to be in T, (fig. 43.) the ſun in S, the moon in L, did the earth and moon conſtantly revolve in the plane of the equator, it is certain that this elevation of the land, D E, would be always equally attracted; but when the earth is not in the equinoxes, this elevated part T, for inſtance, is attracted by the ſun and by the moon, which I ſuppoſe in this ſituation. Then falls out what muſt happen to a biaſſed bowl, or one unequally loaded, rolling on a plane. It would vacillate; it would incline. Conceive this part D falling towards E, by the attraction of the ſun, it cannot paſs from D to E, without the terreſtrial pole, P, changing its ſituation, and moving ſrom P to Z ; but this pole cannot move from P to Z; without the earth's equator anſwering to another part of the heavens than that to which it anſwered before. Thus, at the end of the ſeventy-two years, the points of the equinoxes and ſolſtices anſwer to a different degree in the heavens. Thus, in the time of Hipparchus, the equinox happened when the ſun appeared in the firſt point of Aries, that is, in fact, when the earth was entering Libra, the oppoſite ſign to Aries; and this equinox happens in our days, when the ſun ſeems to be in Taurus; that is, when the earth is in Scorpio, the oppoſite ſign to Taurus Thus all the conſtellations have changed their place; Taurus is where Aries was, and Gemini occupies the place of Taurus.

This gravitation, which is the ſole cauſe of the revolution in twenty-five thouſand nine hundred and twenty years in our globe, is alſo the cauſe of the lunar revolution of nineteen years, called the lunar cycle, and of the revolution of the moon's apſides in nine years. The very ſame thing preciſely happens to the moon, in its rotation round our earth, with regard to this elevation of our globe towards the equator. So that the moon may be conſidered as if it were an elevation or ring belonging to the earth; in the ſame manner, this eminence of the equator may be conſidered as a ring of ſeveral moons.

It is eaſily perceived that the ſun muſt have a greater ſhare than the moon in that motion of the earth, which cauſes the preceſſion of the equinoxes. The action of the ſun, in the preſent caſe, is to that of the moon, exactly as that of the moon is to that of the ſun in the tides.

The reader doubtleſs apprehends, that ſince the waters riſe at the equator, the ſun and moon acting on that equator muſt act more forcibly on the tides. The ſun contributes to this motion of the preceſſion of the equinoxes nearly as three, and the moon as one. On the contrary, in the tides, the ſun acts only as one, and the moon as three. An amazing calculation reſerved for our age, and perfectly conformable to the laws of gravitation, which all nature conſpires to demonſtrate.

CHAP. XI.

OF THE FLUX AND REFLUX. THAT THIS PHÆNOMENON IS A NECESSARY CONSEQUENCE OF GRAVITATION.

The imaginary Vortices cannot be the Cauſe of the Tides. Proved. Gravitation the only evident Cauſe of the Tides.

IF the vortices of ſubtile matter ever had an air of veriſimilitude to recommend them, it is with regard to the flux and reflux of the ocean. If the waters ſink under the tropics, when they riſe towards the poles, it is, ſay ſome, becauſe the air preſſes on the water under the tropics. But why ſhould the preſſure of the air be greater there than elſewhere? It is from its being preſſed itſelf; it is becauſe the courſe of the ſubtile matter is contracted by the paſſage of the moon. What increaſed this veriſimilitude was, that the tides are higher at the new and full moons than in the quarters; and, laſtly, that the return of the tides to each meridian, very nearly followed the return of the moon to each meridian. But what appears ſo very likely is, in reality, quite impoſſible. It has been already ſhewn, that there can be no ſuch thing as theſe vortices of ſubtile matter; but were they real, they could not in the leaſt cauſe the flux and reflux.

1. Suppoſing ſuch a vortex of ſubtile matter, all the lines would equally paſs towards the centre of our

globe. Thus the moon, if at any time preſſing, muſt preſs equally in her quarters and full; therefore there would be no ſuch thing as tides.

2. By a reaſon equally ſtrong, no body carried along by a fluid, can preſs that fluid more than an equal volume of the ſame fluid; a body in equilibre in water, is equal to a ſimilar volume of water. If a hundred entire feet of water more be put into a fiſh-pond, or a hundred fiſh ſwimming on the ſurface, each equal to a cubic foot; or, put only one ſingle fiſh, with ninety-nine feet of water more, the effect will be abſolutely the ſame; in either of theſe caſes, the bed of the fiſh-pond will ſuſtain an equal weight. Thus, whether there was one, or an hundred moons over our ſeas, it would be abſolutely the ſame in the imaginary ſyſtem of vortices and a plenum. Neither of theſe moons are to be conſidered otherwiſe than as an equal quantity of fluid matter.

3. The flux happens in the circumference of the ocean, under the ſame meridian, and in oppoſite points, in the ſame time. The ſea (fig. 44.) ſinks at the ſame time at A and B. Now, granting that the moon could preſs the torrent of ſubtile matter on the ocean, A, the waters would then riſe at B inſtead of ſinking: for gravitation towards the centre is, in this ſyſtem, the effect of the pretended ſubtile matter. Now this imaginary fluid, by preſſing the waters of the ocean at A, muſt raiſe them where its preſſure is leſs; and where can the preſſure be leſs than at B? What is meant by ſaying that B alſo ſinks by a rebound? For when has it been known, that by preſſing any body whatever on one ſide, the oppoſite ſide has been pierced? Take a bladder pretty well filled with air, will there be a cavity on one ſide by making a cavity on the other? Will it not, on the contrary riſe or ſwell in the point oppoſite to that where the preſſure is made?

4. Did this chimerical preſſure obtain, would not the compreſſed air between the tropics cauſe the mercury in the barometer, between the tropics, to riſe? But, on the contrary, the mercury is always ſomething

lower in the torrid zone than towards the poles. Thus what at firſt appeared ſo very ſpecious, when brought to the teſt appears an impoſſibility.

Gravitation, that principle ſo acknowledged, ſo demonſtrated; that force ſo inherent in all bodies, here ſhews itſelf in the moſt conſpicuous manner, as the evident cauſe of the tides. This is very eaſily underſtood. The earth turns on its axis, the ſurrounding waters turn with it. The great circle of every ſpheroid revolving on its axis, is that which has moſt motion; the centrifugal force increaſes in proportion to the magnitude of this circle. This circle, A, (fig. 45.) feels more centrifugal force than the circles B. It is therefore, by this centrifugal force, that the ſea riſes towards the equator; and not only the waters, but even the lands near the equator, are alſo neceſſarily raiſed.

This centrifugal force would carry away all the parts of the earth and ſea, did not its antagoniſt, the centripetal force, draw them towards the centre of the earth. Now every ſea between the tropics and the poles, having leſs centrifugal force, and deſcribing a much ſmaller circle, is more affected by the centripetal force; it gravitates more towards the earth; it preſſes that motion which extends towards the equator, and by this preſſure contributes ſomething to the elevation of the ſea under the line. Such is the ſtate of the ocean, only from the combination of the central forces. Now what muſt follow from the attraction of the moon and the ſun? This conſtant elevation of the waters between the tropics muſt ſtill increaſe, if this elevation happens to be oppoſite to ſome globe which attracts it. Now the region between the tropics of our earth is always under the ſun and moon; therefore the elevation of the ſun and moon muſt have ſome effect on the tropics.

1. If the ſun and moon act on the waters in theſe regions, this action muſt be greater at the time when the moon is moſt oppoſite to the ſun; that is, in oppoſition, and in conjunction, at the full and new moon than at the quarters; for in the quarters, be-

ing more oblique to the ſun, it muſt act on one ſide, when the ſun acts on the other; their actions muſt be oppoſite; one muſt diminiſh the other; accordingly at the ſyzygies the tides are higher than at the quarters.

2. The moon, when new, being on the ſame ſide with the ſun, muſt act the more powerfully on the earth, as it attracts it merely in the ſame direction as it is drawn by the ſun. The tides then, every thing elſe being equal, muſt be ſomething ſtronger in the conjunction than in the oppoſition; and ſo it is found.

3. The higheſt tides of the year muſt fall out at the equinoxes, and they muſt be higher at the new moon than at the full. Draw a line from the ſun paſſing near the moon L (figure 46) and reaching to the equator of the earth. The equator AQ, is attracted by theſe globes almoſt in the ſame line. The waters muſt riſe more than at any other time; and as they can only riſe gradually, their greateſt elevation is not directly at the moment of the equinox, but a day or two after, in DZ.

4. If by theſe laws the tides of the new moon at the equinox are the higheſt in the year, the tides in the quarters after the equinox muſt be the loweſt in the year; for the ſun is yet, very nearly over the equator; but the moon at that time is, as you ſee, very far from it. For the moon L (figure 47) will in eight days be at R. The ocean therefore is in the ſame caſe as a weight drawn by two powers, acting once perpendicularly on it, but now acting only obliquely. Theſe two powers have no longer the ſame force; the ſun no longer gives to the moon the power he added when the moon, earth and ſun were almoſt in the ſame perpendicular.

5. By the ſame laws the tides muſt be ſtronger immediately before the vernal equinox than after; and, on the contrary, ſtronger after the autumnal equinox than before. For if the action of the ſun at the equinoxes, add to the action of the moon; the ſun muſt add the more action in proportion as we ſhall be nearer

that luminary. Now we are nearer the ſun before the 21ſt of March, when he enters the equinox, than after: and, on the contrary, we are nearer the ſun after the 21ſt of September than before. Therefore the higheſt tides, one year with another, ſhould happen before the vernal and after the autumnal equinox, as experience confirms.

After proving that the ſun conſpires with the moon in elevating the ſea, let us inquire into the quantity of this concurrence. Newton and others have calculated the mean elevation in the middle of the ocean at twelve feet: the ſun raiſes it three and a quarter, and the moon eight and three quarters.

Further, theſe tides of the ocean ſeem, like the preceſſion of the equinoxes; and the twenty-five thouſand nine hundred years period of the earth, a neceſſary effect of the laws of gravitation, without our being able to aſſign any final cauſe; for to ſay with ſo many writers that God has given us tides for the convenience of our trade, is forgetting that it is little more than two hundred and fifty years ſince men traded acroſs the ocean; it is alſo a bold affirmation to ſay that the flux and reflux are an advantage to harbours; and even were it true, that the tides of the ocean are ſerviceable to commerce, are we to ſay, that God appointed them for that intention? How many ages have land and ſea ſubſiſted before navigation became ſubſervient to our new wants? What, ſaid an ingenious philoſopher, becauſe at the end of a prodigious number of years, the invention of ſpectacles was completed, ſhall we ſay that God made our noſes to wear ſpectacles? The ſame authors likewiſe aſſure us, that the flux and reflux are appointed by God to prevent the ſea from ſtagnating, and, its conſequence, corruption; they again forget that the Mediterranean does not ſtagnate, tho' it has no tides. When we thus pretend to aſſign the reaſons for every thing God has made, we fall into the ſtrangeſt errors. They who are guided by calculation, weight, and meaſure, often deceive themſelves; what then muſt they do who only gueſs?

We ſhall not here carry our reſearches on gravitation any farther. When the author publiſhed them in 1736, this doctrine was yet quite new in France; it is no longer ſo, and we muſt act according to the times; the more men are become knowing, the leſs ſhould be written.

CHAP. XII.

CONCLUSION.

LET us conclude with a recapitulation of all we have ſaid in this work. 1. That there is an active power impreſſing on all bodies a tendency towards one another. 2. That relatively to the celeſtial globes, this power acts in an inverſe proportion to the ſquares of the diſtances from the centre of motion, and in direct proportion to the maſſes: this power is called attraction with regard to the centre; and gravity with regard to bodies gravitating towards the centre. 3. That this ſame power cauſes moving bodies to deſcend on our earth in a tendency towards the centre. 4. That the ſame cauſe acts between light and bodies, as we have obſerved, tho' in what proportion is unknown.

As to the cauſe of this power, ſo fruitleſsly ſought both by Newton and all his followers, what can we do better than tranſlate what that great man ſays in his laſt page of his principles; in expreſſions that ſhew him equally a ſublime philoſopher and a profound geometrician; "hitherto we have explained "the phænomena of the heavens and our ſea by the "power of gravity; but have not yet aſſigned the "the cauſe of this power. This is certain, that it "muſt proceed from a cauſe that penetrates to the "very centres of the ſun and planets, without "ſuffering the leaſt mention of its force; that operates, not according to the quantities of the ſurfa-

" ces of the particles upon which it acts, as mechani-
" cál cauſes do, but according to the quantity of the
" ſolid matter they contain; and propagates its vir-
" tue on all ſides, to immenſe diſtances, increaſ-
" ing always in the duplicate proportion of the diſ-
" tances," &c. This is ſaying very clearly, and very ſtrongly, that attraction is a principle not mechanical. And ſome lines after he adds " I frame no hypotheſes,
" *hypotheſes non fingo*; for whatever is not deduced
" from phænomena, is to be called an hypotheſis;
" and hypotheſis whether methaphyſical or phyſical,
" whether of occult cauſes or mechanical, have no
" place in experimental philoſophy." I do not ſay, that this principle of gravitation is the only inſtrument of nature; there are probably many other ſecrets we have not yet diſcovered, which conſpire with gravitation in ſupporting the order of the univerſe. Gravitation, for inſtance, does not account for the revolution of planets on their own axes, nor for the determination of their orbs in one direction rather than another, nor for the ſurprizing effects of elaſticity, electricity, and magnetiſm. A time perhaps may come, when by the increaſe of experiments, ſome other hidden principles may be diſcovered. Every thing informs us that matter has many more properties than we are acquainted with. We are yet only on the brink of an immenſe ocean; how many things remain to be diſcovered! But how many things alſo beyond the ſphere of our capacities!

THOUGHTS

UPON THE

NEWTONIAN PHILOSOPHY*.

Addreſſed to the Marchioneſs du CHASTELET.

EMILIA, whoſe deep genius all admire,
You, like a muſe, my labouring break inſpire;
I wake at your command, I dream no more,
But virtue's laws, and nature's paths explore.
Melpomene, the theatre I quit,
No more I idolize a crowded pit:
Let Rufus, ſon of earth, in hobling verſe,
To life's laſt verge a fooliſh thought expreſs,
And aim at me the darts, which he deſign'd
To level at the reſt of human kind.
Four times a month the Zoilus of the age,
May pour in fierce invective ſenſeleſs rage;
Their

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* This letter is printed before Newton's principles, publiſhed by M. de Voltaire in 1738 and 1742.

Their cries, by hatred form'd, I will not hear,
Nor mind their tracks which in the dirt appear:
Divine philoſophy's all powerful charms,
Fell envy of her darts with eaſe diſarms;
Wrapt in his heaven, great Newton ſcarcely knows
Amongſt the ſons of men that he has foes:
Of mine I think not, to my raviſh'd eyes
Truth ſhews how I may to that heaven riſe;
Thoſe vortices, which run ſo ſtrange a race,
Heap'd without order, moving without ſpace.
Thoſe learned viſions paſs like ſmoke away,
Motion's reſtor'd, I ſee a brighter day,
Space, which contains the univerſal ſoul,
Sees in its boſom vaſt creation roll;
God ſpeaks, and at his voice old Chaos flies,
All things towards a common centre riſe;
The ſpring of nature, by dark ignorance night
Conceal'd, had long lain hid from mortal ſight:
Newton the compaſs takes, he lifts the veil,
He makes truths light o'er ignorance prevail:
With learned hand he to my eye diſplays
That ſtar's bright robe, which ſeaſons rules and days;
The ſparkling diamond's variegated dies,
With gorgeous luſtre dazzle human eyes;
Each ray's pure ſubſtance to ſpectators ſhew
The various colours of fair Iris' Bow;
Blended they light impart to mortal eyes,
They vivify the world and fill the ſkies.
Ye miniſtring angels to the king of kings,
You burning ſeraphs, who with conſtant wings
Cover the Almighty power's eternal throne
Of men would you not envy him alone?
He rules the ſea, I ſee the humid deep,
Time ever with attracting Cynthia keep;
Its efforts ſtrong a central power reſtrains,
Ocean rolls back, and in its bed remains;
Comets, which men as much as thunder fear,
To terrify the world at length forbear;

In an ellipſe immenſe your wand'rings end.
Riſe near the ſtar of day and near deſcend;
Your fiery treſſes ſhake, returning ſtrive,
Exhauſted, drooping nature to revive.
Siſter of Phœbus, ſtar, which in the ſkies,
Long time deceiv'd th' inquirer's erring eyes:
Newton has fix'd the bounds of thy career,
Move on, and rule the day the month and year:
Earth, change thy form, and let thy maſſes weight,
Sinking the Pole the Equator elevate;
Pole, which ſeem motionleſs to ev'ry eye,
The Bear that frozen conſtellation fly; *
And let your long protracted periods laſt,
Till numberleſs revolving years are paſt.
What noble objects theſe! what high delight!
Feels the rapt ſoul fill'd with ſuch glorious light!
The mind let looſe from its corporeal chains,
A converſation with its God maintains.
How couldſt thou ſay, whilſt yet in tender youth,
Receive theſe treaſures of eternal truth,
Shun pleaſures which conſume our youthful days,
And to ſuch views ſublime thy genius raiſe;
With Newton tread paths ne'er trod before,
And nature's winding labyrinth explore?
May I with you her temple penetrate,
And to all France theſe truths ſublime relate;
Whilſt Algarotti †, whoſe inſtructions pleaſe,
This ſtranger to the Tyber's ſhore conveys:
Let him with flowers adorn her beauteous face,
Compaſs in hand her lineaments I'll trace:
With my rough pencil I'll expreſs each line,
None can embelliſh beauty ſo divine;
Like you ſhe's noble, beauteous, void of paint,
To do her juſtice all deſcription's faint.

PHI-

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* 'Tis the period of the preſſure of the equinox, which is compleated in 2690, or thereabouts.

† Mr. Algarotti, a young Venetian, publiſhed at Venice a treatiſe upon light, in which he explained attraction. His book, which paſſed through ſeven editions, was very badly tranſlated into French.

PHILOSOPHICAL POEMS

UPON

VARIOUS SUBJECTS.

PHILOSOPHICAL POEMS

UPON

VARIOUS SUBJECTS.

Upon the Nature of VIRTUE.

THE ſpacious earth reſounds fair virtue's fame,
The pulpit, bar, and ſtage, of her declame;
Virtue, 'tis ſaid, can ſometimes penetrate
To courts, and lurk behind the pomp of ſtate.
Virtue's a ſacred name, we always hear
The word pronounced with a delighted ear.
Mortals will ever cultivate deceit,
And ſharpers, greater ſharpers ſtill defeat:
Thus the deluded French blank tickets draw,
Tickets invented by the impoſtor *Law*:
That fool of Scotland, quite engroſs'd by pelf,
Who dup'd all mankind, and then dup'd himſelf.
What's virtue? Say, great Brutus, dear to fame,
Exclaim'd expiring, virtue's but a name.
To Zeno's followers 'twas ſo little known,
They thought all virtue apathy alone.

The Eaſtern Dervice pours to heaven his prayer,
With arms erect, and with a frantic air,
Dancing like mad, he loud invokes the ſkies,
And naming Mahomet in circles flies;
And when awhile he has in circles run,
He thinks the noble taſk of virtue done.
With hempen girdle, and unbluſhing face,
A monk brim full of ignorance and grace,
Does thro' the noſe his ritual rehearſe,
And ſings pſalms render'd ill in Latin verſe:
May piety like this a bleſſing find,
But what good hence reſults to human kind?
To him true virtue never ſure was known,
Who does no good but to himſelf alone.
When he, who truths divine to mortals taught,
Was before Pilate by vile traitors brought:
What is the truth, the Roman Prætor cried,
With all the haughty majeſty of pride?
The man divine, who all truth cou'd explain,
Made no reply, but ſilence and diſdain.
This ſilent eloquence may ſerve to ſhew
That men were never made the truth to know;
But when a ſimple citizen, inſpir'd
With love of truth, the God's advice requir'd
When as a ſage diſciple he explor'd,
How God by mortal man ſhou'd be ador'd;
The heavenly envoy, with the ſubject fir'd,
Declar'd the truth, the truth by God inſpir'd,
And in one word the will divine expreſt,
Love God, and love his creatures to be bleſt.
This is the law divine, the heavens above
Explain'd man's duty when they bid to love;
The world is full of vice, the man who flies,
Mankind can't virtuous be deem'd, but wiſe:
Man ſhou'd himſelf, and all mankind befriend,
Whither, fanatic, does thy phrenzy tend?
Wherefore that jaundic'd cheek, that haggard face,
* Why thoſe convulſions, that unequal pace?

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* Alludes to a ſect, which, went by the name of Convulſionaries.

Againſt the age you rave and ſtraight repair,
To cant at leiſure with ſome pious fair:
There ſaints run mad with ſtrange convulſions ſoar
To heaven, and God-like men poſſeſs'd adore;
There mounted on a ſtage they make loud cries,
Work miracles, and tell prophetic lies;
Thither the blind repair relief to find,
But to their * manſion back return blind;
The lame man leaping falls, the holy band
Lead back the wretch, a crutch in either hand;
The deaf, who dull and void of ſenſe appears,
Liſtens attentive, tho' he nothing hears:
Meantime a troop devout with tranſport fir'd,
And by the fooliſh multitude admir'd,
Preach to weak girls, who willingly give ear,
That the laſt dreadful day is drawing near.
Some ſouls in ſuch things much delight can find,
But don't ſome duties ſtill more ſtrongly bind?
Why does thy friend in want and ſickneſs lie?
Why do you to him needful aid deny?
With ſuch as you ſalvation's for the great,
The poor alone can miſs a bliſsful ſtate.
This judge, they ſay, is upright and auſtere,
Nothing can mollify his ſoul ſevere:
I underſtand he makes mankind deteſt
His power, ſince rigour always ſteels his breaſt.
But was his hand e'er known the world to bleſs,
Did he e'er ſuccour virtue in diſtreſs?
Did he e'er ſerve, or even protect by law,
The man who ſtands in court with humble awe?
His rigour to the guilty has been ſhewn,
The man's not juſt who puniſhes alone.
The juſt are ſtill benevolent. Long ſince,
The wicked miniſter of a virtuous prince,
Thus dar'd his curs'd ſuggeſtions to impart,
Timantes is a Calviniſt in heart;
A work of Calvin's at his houſe was ſeen,
Such odious heretics you ſhou'd not ſcreen;

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* The hoſpital of the quinze-vingt, founded at Paris by St. Lewis, and occupied by 300 blind men.

He ſhou'd in priſon all his life be pent,
Or ſent into perpetual baniſhment.
This anſwer ſtraight return'd the prince auguſt,
Timantes I have faithful found and juſt;
That courtier's faults indeed to light you bring,
But you forget how well he ſerv'd his king.
This monarch's truly noble, wiſe diſcourſe
Inculcates virtue with a ſermon's force.
Shall fraud and inſolent pretenſions claim,
Even ſacred virtue's venerable name?
Shall Germont, weak diſpenſer of the laws,
Who, when Sejanus raves, wont plead my cauſe;
The inſipid Cyrus, he whoſe only care
Is to be prais'd, and ſupper to prepare;
Shall theſe prophane fair virtue's ſacred name?
Virtue with ſcorn rejects the ſenſeleſs claim.
It is not due to theſe, but him who glows
With tenderneſs, and friendſhip's duties knows;
Norman and Cochin virtuous I confeſs,
Whoſe eloquence protected orphans bleſs;
It is not due, vile * Mannori, to thee,
Who ſell thy anger for a paltry fee;
Who eloquence converted to a trade,
And not a pleading, but a libel made:
Judge, to whoſe zeal right reaſon is the guide,
In ſpeech De Thou, a Pucelle to decide;
A tender friend, a gen'rous patron known,
That thou art virtuous ſure all men muſt own.
Enjoy that title, thou, whom men revere,
With wiſdom thou art juſt, but not auſtere:
Thou, amidſt the dazzling pomp of awful ſtate,
Art lov'd as virtuous, not malign'd as great.
An author, whoſe prolific pen compos'd
Plans various, which to mankind he propos'd;
Who long wrote for ungrateful men alone,
Has coin'd a word to Vaugelas unknown.

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* A wretched lawyer, who being out of practice, and reduced to abſolute beggary, had often received pecuniary aſſiſtance from the author, and afterwards pleaded againſt him in a moſt ridiculous manner.

This word I like, this word was made t' impart
Ideas of virtue to the human heart.
You pedants, you grammarians of the ſchools,
Who meaſure ſyllables, and frame new rules :
To you the expreſſion may too bold appear,
But ſurely it muſt pleaſe each virtuous ear.

P O E M.

Upon the EVENTS of the Year 1744.

SHALL France be for ever with folly o'erſpread?
Timon, with ſelf-ſufficiency, laſt winter ſaid,
Timon who Antiquity's great worth proclaims,
And againſt his own times, tho' quite ignorant, declaims.
His way towards Flanders why does our king bend?
Cries he, why abſurdly is he bent to defend,
Why would he the throne of the Cæſars uphold
Attack'd both by huſſars and Engliſh gold?
The young prince of Conti's wits ſurely muſt fail,
Elſe Italy's mountains he'd not try to ſcale,
And near Nice, with a king crown'd with conqueſt, to fight
Upon frozen mountains of ſuch a vaſt height.
To paſs thoſe heaps of ſnow which almoſt meet the ſky,
To this Icarus has Dedalus wings given to fly,
In order his valour in fight to diſplay,
Like Hannibal, can he thro' rocks cut his way?
He growls, Conti flies, and with haſte to engage,
The young with him fly, nor ſee dangers like age;
The ſquadrons with ſpeed paſs the Var's rapid waves
The river in terror rolls backward and raves;

They paſs torrents, rocks, craggy mountains, abyſſes,
And beſiege the Alps ſummit where the heavens it kiſſes;
They brave even the thunder, and on every ſide
Nature, art, and the enemy are yielding deſcry'd.
Conti, who was cenſur'd, men a Hannibal call;
But he does not like Hannibal, at Capua, ſpoil all.
You cenſurers ſevere, has his glory abounded?
With Nice and Demont you are fairly confounded.
But whilſt before Conti Alps ſink to a plain,
And Engliſh ſailors quake with fear on the main,
Lewis fills all with terror on the banks of the Scheld,
And the Dutch by their fears are from troubling him withheld.
Both ſtateſmen and generals, by the ſame zeal excited,
With their prince take the field, by war's terrors delighted.
The ſhades of great Condé and great Lewis, Commanders
Renown'd, both acknowledge their deſcendents in Flanders.
Envy's ſilent, the Prince is applauded by all;
For one month, vile Zoilus, ſhed not thy gall:
The old politician, with a cane in his hand,
Now points out where Ypres, Furne, and Menin ſtand.
'Tis thus when at Paris in a well-written piece,
A poet has rivall'd or ſurpaſs'd antient Greece,
All malice confounded it's ill deſign miſſes,
The ſpectator applauds while the bad Poet hiſſes:
Thus tho' Buſſy wrote with fell fury inſpir'd,
Luxemburgh and Turenne our four-fathers admir'd.
Tho' the French have a trivial and ironical ſpirit,
They always admire and acknowledge true merit;
There are none that diſcover or applaud merit faſter,
Their equal they love, and they honour their maſter.
Virtue plac'd on the throne ſhines with luſtre moſt bright,
And the world's example is the world's delight.

We ſound when the ſever, dire agent of ſate,
Pale, hollow-ey'd, haggard, with hobbling gate,
Made Lewis the great fall a victim to death,
And eſcap'd from war's danger in peace yield his
breath,
For Germanicus' death Roman eyes were leſs welted;
His loſs by the world was not ſo much regretted,
And the tranſport of joy it diſcover'd was leſs
When Antoninus recover'd the world to bleſs.
In th' expreſſions of ſorrow and joy that we made
Our hearts ſpoke aloud, Love alone was diſplay'd.
Paris never its paſſions ſhew'd at other times
By ſo many bonefires, or ſo many bad rhymes.
The poetical ſpirit great king then abounded,
And the muſes the glory of the Monarch reſounded.
The throne's luſtre never was brighter than now,
But laurels are withered on every brow.
Beware, both my proſe and my verſe, to appear,
'Twould be ſad diſgrace to diſpleaſe Lewis's ear:
Yet bards ever to the high honour lay claim
Of conducting the hero to the temple of fame;
But without us the hero to find his way knows,
And the monarch his glory to himſelf only owes.
Such a king every age and each nation admires,
The dying man praiſes him e'er he expires;
From father to ſon the great worth's handed down
Of a king, who with honour has worn the crown;
And his name, which by mankind is lov'd without
meaſure,
In ages remote is repeated with pleaſure.
If, great king, ſome author with true genius
writing,
The thoughts of your people ſincerely reciting,
Shou'd addreſs himſelf to you by the great art of
verſe,
And your virtues to mankind without flatt'ry re-
hearſe,
A taſte you perhaps to his numbers might take,
And excuſe the elogium for the genius's ſake;
Your favours perhaps might Parnaſſus inflame,
And Poets for glory might put in their claim.

Encouragement's potent, 'tis that which imparts
New vigour and life to the languiſhing arts;
And often a monarch's diſcerning ſight
Modeſt merit diſcovers, that flies from the light:
Encouragement each charming art can inſpire;
The favour of monarchs fans poetical fire.

* * *

*THE

WORDLY MAN.

OTHER Smay with regret complain,
That 'tis not fair Aſtrea's reign,
That the fam'd golden age is o'er
That Saturn, Rhea, rule no more:
Or, to ſpeak in another ſtile,
That Eden's groves no longer ſmile.
For my part, I thank nature ſage,
That ſhe has plac'd me in this age:
Religioniſts may rail in vain;
I own, I like this age profane;
I love the pleaſures of a court;
I love the arts of every ſort;
Magnificence, fine buildings, ſtrike me;
In this each man of ſenſe is like me.
I have, I own, a worldly mind,
That's pleaſ'd abundance here to find;
Abundance, mother of all arts,
Which with new wants new joys imparts;

The

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* This Poem was written in 1736. 'Tis a piece of humour founded upon philoſophy and the public good; it's deſign is explain'd in he poem following. See likewiſe Mr. de Melon's letter to the Counteſs of Verrue.

The treaſures of the earth and main,
With all the creatures they contain:
Theſe luxury and pleaſures raiſe;
This iron age brings happy days.
Needful ſuperfluous things appear;
They have joined together either ſphere.
See how that fleet, with canvas wings,
From Texel, Bourdeaux, London brings,
By happy commerce, to our ſhores
All Indus, and all Ganges ſtores;
Whilſt France, that pierc'd the Turkiſh lines,
Sultans make drunk with rich French wines.
Juſt at the time of nature's birth,
Dark ignorance o'erſpread the earth;
None then in wealth ſurpaſs'd the reſt,
For naught the human race poſſeſt.
Of clothes, their bodies then were bare,
They nothing had, and cou'd not ſhare:
Then too they ſober were and ſage,
* Martialo liv'd not in that age.
Eve, firſt form'd by the hand divine,
Never ſo much as taſted wine.
Do you our anceſtors admire,
Becauſe they wore no rich attire?
Eaſe was like wealth to them unknown,
Was't virtue? Ignorance alone.
Wou'd any fool, had he a bed,
On the bare ground have laid his head?
My fruit-eating firſt father, ſay,
In Eden how roll'd time away?
Did you work for the human race,
And claſp dame Eve with cloſe embrace?
Own that your nails you cou'd not pare,
And that you wore diſorder'd hair,
That you were ſwarthy in complexion,
And that your amorous affection
Had very little better in't
Than downright animal inſtinct.
Both weary of the marriage yoke
You ſupp'd each night beneath an oak

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* The author of a treatiſe entitled the FRENCH COOK.

On Millet, Water, and on Maſt,
And having finiſhed your repaſt,
On the ground you were forced to lie,
Expos'd to the inclement ſky.
Such in the ſtate of ſimple nature
Is man, a helpleſs wretch'd creature.
Would you know in this curſed age,
Againſt which zealots ſo much rage,
To what men bleſs'd with taſte attend
In cities, how their time they ſpend.
The arts that charm the human mind
All at his houſe a welcome find;
In building it the architect
No grace paſs'd over with neglect.
To adorn the rooms, at once combine
Pouſſin, Correggio the divine,
Their works on every pannel plac'd
Are in rich golden frames incas'd.
His ſtatues ſhew * Bouchardon's ſkill,
Plate of Germain †, his ſide-boards fill.
The Gobelins Tapeſtry, whoſe dye
Can with the painter's pencil vye,
With gayeſt colouring appear
As ornaments on every pier.
From the ſuperb ſalon are ſeen
Gardens with Cyprian myrtle green.
I ſee the ſporting waters riſe
By jetteaus almoſt to the ſkies.
But ſee the maſter's ſelf approach
And mount into his gilded coach,
A houſe in motion to the eyes
Is ſeems, as thro' the ſtreets it flies.
I ſee him thro' tranſperant glaſſes
Loll at his eaſe as on he paſſes.
Two pliant and elaſtic ſprings
Carry him like a pair of wings.

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[*] A famous ſtatuary born at Chaumont in Champagne.

[†] An excellent goldſmith, whoſe deſigns and works diſcover the moſt exquiſite taſte.

At Bath, his poliſh'd ſkin inhales
Perfumes, ſweet as Arabian gales.
Camargot at the approach of night,
Julia, Goſſin by turns invite.
Love kind and bounteous on him pours
Of choiceſt favours plenteous ſhowers.
To th' opera houſe he muſt repair,
Dance, ſong and muſic charm him there.
The painter's art to ſtrike the ſight,
Does there with that bleſt art unite;
The yet more ſoft perſuaſive ſkill,
Which can the ſoul with pleaſure thrill.
He may to damn an opera go,
And yet perforce admire Remeau.
The cheerful ſupper next invites
To luxury's leſs refined delights.
How exquiſite thoſe ſauces flavour!
Of thoſe ragouts I like the ſavour.
The man, who can in cookery ſhine,
May well be deemed a man divine.
Cloris and Ægle at each courſe
Serve me with wine, whoſe mighty force
Makes the cork from the bottle fly,
Like light'ning darting from the ſky.
Bounce! to the cieling it aſcends,
And laughter the apartment rends.
In this froth, juſt obſervers ſee
Th' emblem of French vivacity.
The following day new joys inſpires,
It brings new pleaſures and deſires.
Mentor, Telemachus, deſcant
Upon frugality, and vaunt
Your Ithaca and your Salentum
To antient Greeks, ſince they content 'em:
Since Greeks in abſtinence could find
Ample ſupplies of every kind.
The work, though not replete with fire,
I for it's Elegance admire:
But I'll be whipt Salentum thro'
If thither I my bliſs purſue.

Garden of Eden much renow'd,
Since there the devil and fruit were found,
Huetius, Calmet, learned and bold,
Inquir'd where Eden lay of old:
I'm not ſo critically nice,
Paris to me's a Paradiſe.

The WORLDLY MAN vindicated;

OR,

An APOLOGY for LUXURY.

AT dinner, 'twas one day my caſe,
By a rank bigot to have place,
Who ſaid, I on it might depend,
That hell would have me in the end;
And he an angel heaven's hoſt in
Would loudly laugh to ſee me roaſting.
Roaſting for what? Why, for your crimes;
You've told us in ſome impious rhymes,
That Adam, ere the days of ſin,
Was oft with rain wet to the ſkin;
That he his time moſt dully ſpent,
Eat fruit, and drank the element;
That he his nails could never pare;
And that he was not over fair.
You Epicurus's doctrine teach,
And for luxurious pleaſures preach.
Having theſe words in paſſion ſaid,
He ſwallow'd wine like amber red:
Of wine, which by it's taſte confeſs'd
The grape from whence the juice was preſs'd.

And I, whilſt crimſon ſtain'd his face,
Addreſs'd the ſaint brimful of Grace.
Religious ſir, whence comes this wine?
I own it's guſto is divine.
This wine is from Canary brought,
Said he, and ſhould be nectar thought;
It is in every reſpect
A liquor fit for the elect.
That coffee, which when full refection
The feaſt has given, ſo helps digeſtion.
Whence comes it? It from heaven deſcended,
A gift by God for me intended.
But ſure 'twas in Arabia ſought
By men, and thence with trouble brought.
Both porcelaine and China ware
For you men labour'd to prepare;
Twas bak'd, and with a thouſand dyes
Diverſified, to pleaſe your eyes:
That ſilver, where ſuch art's diſplay'd,
Of which cups, ſalvers, plates are made,
Which with mild luſtre faintly ſhines,
Was dug from Potoſi's rich mines.
For thee the world at work has been,
That thou at eaſe might vent thy ſpleen
Againſt that world, which for thy pleaſure
Has quite exhauſted all it's treaſure.
Thou real worldling learn to know
Thy ſelf, and ſome indulgence ſhew
To others, whom ſo much you blame
For vices, whilſt you have the ſame.
Know luxury, which deſtroys a ſtate
That's poor, enriches one that's great;
That pomp and ſplendor, deem'd ſo vain,
Are proofs ſtill of a proſperous reign.
The rich can ſpend his ample ſtore;
The poor is graſping ſtill at more.
On yon caſcades now fix your ſight,
In them the Naiads take delight;
See how thoſe floods of Water roam,
Covering the marble with a foam.

Theſe waves give moiſture to the fields,
Earth beautify'd more rich crops yields.
But ſhould this ſource be once decay'd,
The graſs would wither, flowers would fade.
Thus wealth, in France and Britain's ſtates,
Thro' various channels circulates.
Exceſs prevails, the great are vain
Their follies oft the poor maintain;
And Induſtry, which opulence hires,
To riches by ſlow ſteps aſpires.
I hear a ſtanch'd pedantic train
Of pleaſures ill effects complain,
Why Dyoniſius, Dyon cite,
Plutarch and Horace the polite,
And cry that Curius, and a ſcore
Of conſuls, ending in *us* more,
Till'd the earth during war's alarms,
And managed both the plow and arms;
That corn, which flouriſh'd in the land,
Was ſown by a victorious hand.
'Tis well, ſirs, and I am content
To ſuch relations to aſſent.
But tell me, ſhould the gods incite
Auteil againſt Vaugirard to fight,
Muſt not the victor from the field
Returning home his land have till'd.
Rome the auguſt was heretofore
A hole like Auteil, nothing more,
When thoſe chiefs, from god Mars deſcended,
Attack'd a meadow or defended,
When to the field they took their way,
Their ſtandard was a truſs of hay [*].
Jove's image, wooden under Tullus,
Was beaten gold when liv'd Lucullus.
Then don't beſtow fair virtue's prize
On what from poverty had riſe.
France flouriſh'd by wiſe Colbert's care,
When once a dunce, intent to ſpare,

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[*] A handful of hay at the end of ole called MANIPULUS, was the firſt ſtandard of the Romans.

Preſum'd the progreſs to oppoſe
Of arts, by which fam'd Lyons roſe,
And by curſt avarice poſſeſt
Had induſtry and arts ſuppreſt;
That miniſter, as wiſe as great,
By luxury enrich'd the ſtate.
He the great ſource of arts increas'd,
From north to ſouth, from weſt to eaſt,
Our neighbours all with envy fir'd
Paid dear for genius they admir'd.
A monarch's portrait here I'll draw,
Rome, Paris, Peking, ſuch ne'er ſaw;
'Tis Solomon, that king who ſhone
A Plato, whilſt he fill'd a throne;
Who all things was to know allow'd,
From hyſſop to the cedar proud:
In luxury he ſurpaſs'd mankind,
With glittering gold his palace ſhin'd.
All various pleaſures he could taſte,
A thouſand beauties he embrac'd.
With beauties he was well ſupplied;
Give me but one, I'am ſatisfy'd.
One's full enough for me; but I
Cannot with ſage or monarch vie.
Thus ſpeaking, I perceiv'd each gueſt
To approve of my diſcourſe profeſt.
Sir Piety no more reply'd,
But, laughing, ſtill the bottle ply'd,
Whilſt all, who well knew what I meant,
Seem'd to my reaſons to aſſent.

ON PRINTED LIES.

WE may at preſent divide the inhabitants of Europe into authors and readers, as they were for ſeven or eight ages divided into a ſet of barbarous tyrants with hawks on their fiſts, and ſlaves who were deſtitute of every neceſſary of life.

It is now about two hundred and fifty years ſince men, by degrees, began to conceive ſome notion they had ſuch a thing as a mind: now every perſon reads, either to cultivate or adorn his mind, or, at the leaſt, that he may be able to boaſt of his reading. As ſoon as the Dutch perceived this new want of the ſpecies, they became the factors of the commodity called Thought, as they had formerly been for our wines and ſalt: ſo that a bookſeller of Amſterdam, that could not read, gained a fortune of a million by the labours of a few Frenchmen, that took it into their heads to become authors. Theſe merchants informed themſelves, by their correſpondents, of the moſt marketable commodities; and according to the wants of the public, ſet their workmen to the writing hiſtories or romances; but chiefly the former, becauſe, after all, we cannot help believing there may be ſome ſmall matter of truth in every thing that wears the title of a New Hiſtory, Hiſtorical memoirs, and Anecdotes, more than could well be expected from what paſſes under the denomination of a Romance. In this manner did the Journeymen and labourers of thoſe dealers in paper and ink compoſe the Memoirs d'Artagnan, de Pontis, de Vordac, de Rochefort, with ſo many others, in which we find a very circumſtantial account of all the ſecret thoughts of kings and prime miniſters, together with a hundred thouſand public tranſactions that were never heard of before. Your young German barons, your Poliſh palatines, your dames of Stockholm and Copenhagen, read thoſe books, and believe they are thereby informed of the moſt hidden ſecrets of the court of France.

Varillas was infinitely ſuperior to the noble authors I am ſpeaking of, though he frequently takes very unwarrantable liberties. He ſaid, one day, to one who ſaw him ſomewhat puzzled, "I have three ſovereigns, whom I muſt engage in converſation together: now none of the three ever ſaw one another; and, I cannot tell, for the ſoul of me, how to contrive to bring it to paſs." "So then, ſays the other, I ſuppoſe you muſt be writing ſome tragedy?"

Every one has not been bleſſed with invention: therefore it is, that we find the fables of antiquity, which were formerly printed in *folio*, reprinted a ſecond time in *duodecimo*. I fancy one might diſcover, in upwards of two hundred authors, the ſame prodigies, and the ſame predictions, that were made in the time when aſtrology paſſed for a ſcience. We ſhall poſſibly be told again, how two Jews, whoſe only talents were ſelling of old cloaths, and clipping of old coins, promiſed the empire to Leo the Iſaurian, and demanded of him, that he would throw down the images of the Chriſtians as ſoon as he ſhould be ſeated on the imperial throne; as if Jews cared much whether we had any images or no. I do not deſpair to ſee it printed a ſecond time, how Mahomet II. ſurnamed the Great, the moſt enlightened prince of his time, and the moſt magnificent encourager of the arts, ſpread fire and ſword through Conſtantinople (which, by the bye, he preſerved from pillage), demoliſhed all the churches (of which he actually preſerved above one half,) cauſed the patriarch to be impaled; he who paid more honour to the patriarch than had ever been ſhewn him by the Greek emperors; had the bellies of four pages ripped up, that he might diſcover which of them it was that had eaten a melon; and, laſtly, cut off his miſtreſſes's head to pleaſe the Janiſaries. Theſe hiſtories worthy only of Jack the Giant-killer, and of Blue-beard, are ſold every day with approbation and privilege.

Some wiſer heads have bethought themſelves of another art of lying. They have made themſelves heirs to all the great miniſters, and have got poſſeſſion of all their teſtaments. We have ſeen the teſtaments of Colbert and de Louvois publiſhed as authentic pieces by refined politicians, who never once croſſed the threſhold of the offices of the ſecretary at war, or of the treaſury, in their lives. The teſtament of cardinal Richelieu, written by a hand rather better than the reſt of them, has had a better fate, and the impoſture paſſed well enough for a conſiderable time. It is really pleaſant to ſee, in collections of harangues, what elogiums have been laviſhed on the admirable teſtament of that incomparable cardinal. In this piece we find his great depth of genius; and a ſimpleton, who had read it with a great deal of care, and had made a number of extracts from it, thought himſelf fit to govern the univerſe. The public has been as much impoſed upon by the Teſtament of Charles V. duke of Lorraine: in this they diſcovered the vaſt penetration and the very ſpirit of that prince; though they, who were in the ſecret, very plainly diſcovered the ſpirit of M. de Chevremont, who wrote it.

After theſe teſtament-writers came the authors of anecdotes. We have a ſmall hiſtory, printed, in 1700, written by one mademoiſelle Durand, a perſon well acquainted with the facts ſhe related, under the title of "The Hiſtory of the Amours of Gregory VII. Cardinal Richelieu, the Princeſs of Condé, and the Marchioneſs d'Urfe." I have read ſome years ſince the Amours of the Rev. Father la Chaiſe, confeſſor to Lewis XIV.

A lady of great honour †, a refugee at the Hague, compoſed, in the beginning of the preſent century, ſix large volumes of Letters, between a lady of quality in the country, and a lady of quality in Paris, informing one another, very familiarly, of the news of the times. Now, in theſe news of the times, I will venture to ſay there is not one piece of true intelligence. All the pretended adventures of the Chevalier de Bouillon, ſince known under the name of the Prince of Auvergne, are here related with all their circumſtances. I had one day the curioſity to aſk the chevalier, whether there was any foundation for what Mrs. Du Noyer had placed to his account. He aſſured me, on his honour, the whole was nothing but a collection of falſhoods. This lady had gathered together all the ſilly ſtories current among the populace, which, in foreign parts, paſſed for the hiſtory of the court.

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† Mrs. Du Noyer.

Sometimes the authors of ſuch hiſtories do more miſchief than they think for. A few years ago a perſon of my acquaintance, not knowing how to employ his time, printed a little book, in which he gave out that a certain celebrated perſonage had lately periſhed by a moſt horrible aſſaſſination. I myſelf was an evidence of the contrary: I repreſented to the author how, by all laws divine and human, he was under an obligation to retract this falſhood, which he accordingly promiſed he would: yet the effect of his piece ſtill remains, and I have ſeen this calumny repeated in ſome of the pretended hiſtories of the age.

There has lately appeared a political work at London, the city, of all the cities in the univerſe, where the falſeſt news are publiſhed, with the falſeſt reaſonings upon thoſe falſities. “Every body knows, ſays the author, (p. 17) that the emperor Charles VI. died of poiſon given him in *aqua tuſſana:* we know his favourite page was a Spaniard, to whom he left a legacy by his will, and who gave him the poiſon. The magiſtrates of Milan, who took the depoſition of this page a little before his death, and ſent it to Vienna, might tell us, if they pleaſed, who his inſtigators and accomplices were; and I could be glad the court of Vienna would, as ſoon as poſſible, inform the public of the circumſtances of this horrible crime.” I fancy the court of Vienna will cauſe them to wait a long while for the information they want, in regard to this chimera.

Theſe calumnies, which are perpetually renewing, often put me in mind of the following verſes:

Les oiſifs courtiſans, que leurs chagrins dévorent,
S'efforcent d'obſcurir les aſtres quils adorent;
Si l'on croit de leurs yeux le regard pénétrant,
Tout miniſtre eſt un traître, & tout prince un tyran;

L'hymen n'eſt entouré que de feux adultéres ;
Le frére à ſes rivaux eſt vendu par ſes fréres ;
Et ſi tôt qu'un grand roi panche vers ſon déclin,
Ou ſon fils ou ſa femme ont hâté ſon deſtin. . .
Qui croit toujours le crime en paraît trop capable.

The courtly fry, from diſappointment ſore,
With ſlander blacken what they ſhould adore.
Truſt their remarks, they'll prove it clear as day,
All kings oppreſs, all miniſters betray.
Adultrous fires ſurround the marriage-bed ;
The brothers blood the brother's hand hath ſhed ;
Should ſome great monarch touch the goal of life,
His fate is haſten'd by his ſon or wife.
Of guilt that man too capable appears,
Who credits thus each horrid tale he hears.

In this manner have the pretended hiſtories of the age generally been written.

The war of 1702, and that of 1741, have produced as many lies in books, as they killed ſoldiers in their campaigns : they have told a hundred times over, and they tell it ſtill, that the miniſtry of Verſailles forged the teſtament of Charles II. king of Spain. Some anecdotes tell us, that the laſt marechal de la Feuillade failed in the attempt on Turin, and ſacrificed his reputation, his fortune, and his army, purpoſely, and by a capital ſtroke of politics. Others of them aſſure us, that a certain miniſter was the cauſe of the loſs of a battle, by a like ſtroke of politics. They have lately reprinted in the Tranſactions of Europe, that at the battle of Fontenoy we loaded our cannon with pieces of glaſs and poiſoned ſhot ; that general campbell was killed by one of thoſe poiſoned bullets ; upon which the duke of Cumberland ſent the king of France a box, in which were contained the glaſs and metals extracted from his wound ; that in this box was encloſed a letter, in which he tells the king, that the moſt barbarous nations had never made uſe of ſuch weapons, and that the king was highly diſpleaſed on reading this letter. There is not the leaſt ſhadow of truth or probability in this account. To theſe abſurd lies they add, that we murdered the wounded Engliſh that remained on the field of battle in cold blood ; though it ſtands proved by the regiſters of our hoſpitals, that we took the ſame care of them as of our own ſoldiers.

How numerous are the ſecret memoirs, hiſtories, of champaigns, and journals of all kinds! the prefaces to which promiſe the utmoſt impartiality, and the moſt exact information. If you viſit one of theſe great politicians, you will find a poor ſcribe in a banian and night-cap, without fire or furniture, compiling or cobbling of news-papers. Sometimes theſe gentlemen will take a power under their protection. The ſtory of one of theſe writers is well known, who had a reward of the emperor Leopold, at the cloſe of the laſt war, for having kept him an army of fifty thouſand men on the Lower Rhine for five years running. They will alſo ſometimes declare war, and commit acts of hoſtility; though they run the riſk of being treated as enemies. One of them called Dubourg, who kept his office in Frankfort, was unluckily arreſted there by an officer of our army in 1748, and conducted to Mount St. Michael in a cage: and yet this example is far from cooling the courage of his magnanimous brethern.

One of the moſt noble and moſt common tricks of this kind is that of thoſe writers who transform themſelves into miniſters of ſtate, and lords belonging to the court in the country they ſpeak of. We have been favoured with a voluminous hiſtory of Lewis XIV. compiled from the memoirs of a miniſter of ſtate. This miniſter was a Jeſuit, who had been expelled his order, and had taken ſanctuary in Holland, under the name of de la Stode, and who afterwards thought proper to create himſelf ſecretary of ſtate for France in Holland for bread.

As it is always fitting to imitate good models, and as my lord chancellor Clarendon and the cardinal de Retz have drawn portraits of the principal perſonages they treat of, we ought by no means to wonder that the writers of our own times ſhould, on hiring themſelves to a bookſeller, begin with very long and faithful portraits of the princes of Europe, and even the miniſters and generals, though they have never ſo much as ſeen a lacquey who wore their livery. An Engliſh author, in the Annals of Europe, printed and reprinted, aſſures us, that Lewis XV. has nothing of that grandeur in his air and gait which ſpeaks the king. This perſon muſt undoubtedly be very difficult and nice, with regard to phyſiognomies. But, to make amends, he tells us, that cardinal Fleury had an air of noble confidence. He is full as exact in regard to characters and facts as he is to perſons: he informs Europe, that cardinal Fleury gave up his title of prime miniſter (which he never had) in favour of the count de Thoulouſe. He acquaints us, the army of marechal Maillebois was ſent into Bohemia, only becauſe a young lady of the court had left a letter on the table, which letter gave information of the ſituation of affairs: he ſays the count d'Argenſon ſucceeded as miniſter at war, in the room of M. Amelot. I fancy, if one were willing to make a collection of all the books written in this manner, in order to become a little acquainted with the anecdotes of Europe, one might make an immenſe library, without ten pages of truth in the whole collection.

Another conſiderable article in this trade of printed paper is in theſe books called polemical, by way of excellence; that is to ſay, thoſe in which one ſlanders his neighbours to get money. I do not ſpeak of the functions of advocates, who enjoy the noble privilege of beſpattering the adverſe party at pleaſure, and defaming families according to ſtatute. I ſpeak of thoſe who in England, for example, excited by an ardent love of their country, write Philippics, worthy of Demoſthenes, againſt the miniſter, in their garrets. Theſe pieces are ſold for two-pence a ſheet: ſometimes they will print you four thouſand copies, which is enough to keep one of thoſe eloquent citizens alive for a month or two. I have head Sir Robert Walpole ſay, that one day one of theſe Demoſthenes's, who ſell their works at two-pence a ſheet, having as yet declared himſelf of no party in the parliamentary diſſentions, came to make him an offer of his pen to knock down all his enemies. The miniſter very civilly thanked him for his kind offer, and excuſed himſelf from accepting his ſervice. "You will not be offended then, anſwered the writer, if I make your antagoniſt, Mr. Pulteney, a tender of my aſſiſtance?" So away he hies to him, and he met with much ſuch another reception. He declared openly againſt both; ſo that on Monday he wrote againſt Mr. Walpole, and on the Wedneſday againſt Mr. Pulteney. But after getting a very honourable ſubſiſtence by it for a matter of two months, he concluded with aſking charity at their doors.

The celebrated Pope was in his time treated exactly like a miniſter: his reputation made many men of letters imagine ſomething might be got by him. For the honour of learning, and in order to advance the progreſs of the human mind, they printed againſt him above an hundred libels, in which they proved him to be an atheiſt; and, what is yet worſe in England, they reproached him with being a catholic. They affirmed, on his publiſhing his tranſlation of Homer, that he did not underſtand Greek, becauſe he was crooked and had an ill ſmell. It is true he was crooked; but this was no reaſon why he might not be a very good Greek ſcholar, and his tranſlation of Homer a very noble one. They impeached his morals, his education, his birth; they attacked his father and mother. Theſe libels had no end. Pope had ſometimes the weakneſs to anſwer them, which thickened the cloud of libels. At length he determined to be at the trouble to print a ſmall * compendium of all thoſe excellent pieces. This was a mortal blow to theſe writers, who till then had lived very decently on the ſlanders they vented againſt him: they were now no longer read, and were ſilenced by the abridgment. They never recovered this ſtroke after.

I was ſtrongly tempted to grow vain, on finding that our great writers dealt with me in the ſame manner as thoſe gentry had uſed Pope. I may ſafely ſay, I have been of ſome little ſervice to more than one author. I had, I forgot how, done ſome little ſervice to the illuſtrious abbé de Fontaines. But as this ſervice was not ſufficient to maintain him, the firſt thing he thought of, in order to get rid of his difficulties, on coming out of

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* We ſuppoſe M. de Voltaire alludes to the Dunciad, which, inſtead of being *un petit abregè*, is a moſt excellent poem.

of the jail from whence I delivered him, was the publiſhing a dozen libels againſt me, which, in truth, he compoſed wholly out of his regard for the honour of letters, and from the overflowing of his zeal for good taſte. He printed an edition of the Henriade, in which he had foiſted ſome verſes of his own compoſing, and then criticiſed thoſe very verſes he had made himſelf. I have carefully preſerved a letter wrote me upon a time by an author of this ſtamp: "Sir, I have printed a libel againſt you: there are four hundred copies in the impreſſion; now, if you will ſend me four hundred livres, I will ſend you every copy of the work, upon my honour." I wrote him in anſwer, that I ſhould be very far from abuſing his gooodneſs; that this would by no means be an advantageous bargain for him; and that the ſale of his work muſt certainly be of much more ſervice to him. I had no cauſe to repent of my generoſity.

It is a good-natured action to encourage men of letters who are unknown, and who know not what ſubject to begin with. One of the greateſt pieces of charity that can be done them, is to give the public a tragedy. The moment you do this, all of a ſudden come out "Letters to Ladies of Quality, an impartial Criticiſm of the new Play, a Letter from a Friend in Town to his Friend in the Country, a ſerious and mature Examination, the new Tragedy taken to pieces and examined ſcene by ſcene;" every one of which is greedily bought up, which is the point aimed at.

But the moſt curious ſecret of all, for an honeſt bookſeller, is to take care to print, at the end of the book he publiſhes, all the abuſe and ribaldry that has been written againſt the author. Nothing is better calculated to whet the curioſity of the reader, and to quicken the ſale. I remember, among the execrable editions that have been printed in Holland of my pretended works, an artful editor of Amſterdam, who was deſirous to ſink the credit of an impreſſion printed at the Hague, thought proper to add, by way of appendix, a collection of all the ribaldry he could ſcrape together that had been written againſt me. The firſt words of this collection called me a ſnarling cur. I found this book at Magdeburg, in the hands of the poſtmaſter, who never ceaſed telling me what an eloquent piece it was. Lately two worthy bookſellers of Amſterdam, after having disfigured, as much as in them lay, the Henriade, and my other pieces, did me the honour to acquaint me by letter, that if I perſiſted in my intention of permitting a better edition of my works to be publiſhed at Dreſden, than that which they were then engaged in, they ſhould hold themſelves bound in conſcience to publiſh againſt me a volume of the moſt atrocious calumnies, on the fineſt writing paper with a large margin, and the moſt beautiful letter they could procure. They have been as good as their word with me. It is a pity ſuch valuable collections ſhould have been buried in oblivion. Formerly, when there were eight or nine hundred thouſand volumes fewer in Europe than at preſent, thoſe pieces of ſcandal had their effect. People read with extreme reliſh in Scaliger, that cardinal Bellarmin was an atheiſt, the reverend father Clavius a drunkard, and that the reverend father Cotton had ſold himſelf to the devil. Theſe were happy days; but, alas! every thing degenerates.

ON PRINTED LIES.

VERY little has been ſaid on printed lies with which the world has been deluged: it would be no difficult matter to write a large volume on the ſubject; but we know we are not to do all that may be done. We ſhall here only give a few general rules, to caution mankind againſt that multitude of books, in which errors and falſities have been tranſmitted from age to age.

We are apt to ſtart at the ſight of a numerous library, and to exclaim, What a diſmal thing is it to be condemned to remain ignorant of almoſt all it contains! Do not be caſt down: there is very little reaſon for ſorrow in the caſe. Obſerve thoſe four or five thouſand volumes of the ancient metaphyſical writers: they contain not a word of truth till the time of Galileo. Look into the hiſtories of a multitude of nations; their firſt ages are nothing but abſurdities. After the fabulous times come thoſe called heroical: the firſt are no better than the Perſian Tales, where every thing is invention; the ſecond are of the ſame kind with our romances of knight-errantry, where nothing is true, except a few names, and two or three dates.

Here then are already many thouſand years and volumes, in which there is nothing to be learned; ſo that we reſt perfectly ſatisfied as to that point. Next come the hiſtorical times, where the ground of the ſtory is true, and moſt of the circumſtances lies: but amongſt all thoſe lies, are there no truths? Yes, much ſuch a proportion as of gold duſt in the ſands of ſome rivers. Perhaps I ſhall here be aſked, how this gold is to be found. In this manner. Whatever is neither conſiſtent with phyſical nor rational truths, nor the temperament of the human mind, is nothing but ſand: the reſt, provided it has the concurrent teſtimony of the wiſe men of the age, is the gold duſt you ſeek for.

Herodotus relates, to the whole body of the Greeks aſſembled, the hiſtory of the neighbouring nations: he is laughed at by all men of ſenſe, when he talks of the predictions of Apollo, and the fables of Egypt and Aſſyria; nor did he believe them himſelf. All that he relates on the credit of the Egyptian prieſts is falſe; every thing which he ſpeaks of, as an eye-witneſs, has been confirmed ſince. We ought certainly to rely on what he ſays, when he tells his Grecian auditors, "There is among the treaſures of the Corinthians a golden lion, weighing three hundred and ſixty pounds weight, which is a preſent made them by Crœſus: in the ſame place likewiſe we are ſhewn two tuns, the one of ſilver, and the other of gold, which he preſented to the temple of Delphos: that of gold weighs about five hundred pounds, and that of ſilver contains about two thouſand four hundred pints." However extraordinary this magnificence may appear to us, and however ſuperior it may ſeem to any thing we are acquainted with, it cannot be called in queſtion. Herodotus ſpeaks to a matter of fact, of which there were upwards of an hundred thouſand witneſſes. This fact is very important on another account, as it proves to us, that in the Leſſer Aſia, in the time of Crœſus, there was a greater magnificence, than we ſee at preſent; and this magnificence, which can only be the fruit of a great number of ages, proves a very high antiquity, whereof there remain not at preſent the ſmalleſt traces. The prodigious monuments which Herodotus ſaw in Egypt, and at Babylon, are moreover inconteſtable facts.

The caſe is not the ſame with regard to ſolemnities, inſtituted to celebrate an event: moſt falſe reaſoners tell us, here is a ceremony inſtituted from time immemorial, therefore the event ſo celebrated muſt certainly be true; but yet philoſophers will often reverſe the argument, and ſay, therefore that event never had exiſtence.

The Greeks celebrated the Pythian games, in memory of the ſerpent Python, which Apollo aſſuredly never ſlew: the Egyptians celebrated the admiſſion of Hercules into the number of the twelve great gods; yet there is no likelihood that this Hercules of Egypt exiſted ſeventeen thouſand years before the reign of Amaſis, as was aſſerted in the hymns ſung to his honour. Greece aſſigned nine ſtars in the heavens to the dolphin which carried Arion on its back. The Romans celebrated this pretty adventure in February. The Salian prieſts carried in proceſſion, on the firſt of March, the ſacred bucklers that fell from heaven, when Numa, having bound Faunus and Picus, learned from them the ſecret of turning aſide the force of thunderbolts. In ſhort, there never was a people who have not ſolemnized, by ceremonies, the moſt abſurd imaginations.

As for the manners of the barbarous nations, whatever a ſenſible and ocular witneſs ſhall relate concerning them, be it ever ſo ridiculous, ſo infamous, ſo ſuperſtitious or abominable, I ſhall be very inclinable to believe it of human nature. Herodotus affirms, before all Greece, that the inhabitants of thoſe immenſe countries, lying beyond the Danube, prided themſelves in drinking the blood of their enemies out of human ſkulls, and in cloathing themſelves in their ſkins. The Greeks, who carried on a commerce with theſe barbarians, might have detected Herodotus, had he been guilty of exaggeration. It is certain, that upwards of three-fourths of the inhabitants of the globe have lived for a long time like wild beaſts: they are born ſuch. They are ſo many baboons who are taught to dance; and ſo many bears chained up by the mere force of education. That which the czar Peter found neceſſary to do in part of his dominions is a proof of what I advance, and renders all that Herodotus relates extremely credible.

After Herodotus, the ſubſtance of hiſtory becomes much more true, and the facts more circumſtantial; but very often we meet with as many lies as there are circumſtances. Can I believe the hiſtorian Joſephus, when he tells me that the ſmalleſt town in Galilee contained fifteen thouſand inhabitants? By no means I cannot help declaring that he has exaggerated: he thought he ſhould do his country honour by ſo bold an aſſertion, inſtead of which he has degraded it in the eyes of mankind. What a ſhame was it for the Jewiſh people if they were really ſo numerous, to ſuffer themſelves to be ſo eaſily ſubdued by a handful of Romans!

Moſt hiſtorians reſemble Homer; they ſing of battles: but, of all this dreadful number of combats, there are not any, if we except the retreat of the ten thouſand in Xenophon, the battle fought between Scipio and Hannibal at Zama, deſcribed by Polybius, and that of Pharſalia, related by the conqueror, capable of affording the reader the ſmalleſt inſtruction: every avery where elſe, I can ſee nothing but mankind cutting one another's throats, and nothing further †.

We may believe all the horrors to which princes have been driven by their ambition, with every act of folly which mankind have committed through ſuperſtition. But how could hiſtorians deſcend ſo low as to admit of ſupernatural prodigies the tricks deviſed by conquerors, and adopted by the people?

The inhabitants of Algiers firmly believe their city to have been ſaved by a miracle, when Charles V. was coming to beſiege it. They ſay that one of their ſaints ſtruck the ſea, and a ſtorm aroſe which deſtroyed one half of the emperor's fleet.

How many of our hiſtorians have written as if they had been Algerines! How laviſh have they been of their miracles againſt the Turks, and againſt heretics! They have often treated hiſtory as Homer has done the ſiege of Troy. They intereſt all the powers of heaven in the cauſe or defence of a city. But can men, who profeſs to tell truth, imagine that the Divine Being ſides with one petty nation that is at war with another, full as inconſiderable, in ſome inſignificant and remote corner of our hemiſphere?

No one has a greater veneration for St. Francis Xavier than I have: he was a Spaniard, animated with the moſt intrepid zeal; he was the Ferdinando Cortez of religion. But I cannot help thinking the writers of his life ſhould not have aſſerted ſo roundly, that this great man was in different places at the ſame time.

If any one has a right to pretend to the gift of working miracles, it is undoubtedly thoſe who carry their charity and their doctrine to the extremities of the earth. I could have been glad, however, had their miracles been a little leſs frequent; that they had raiſed fewer of the dead; and that they had not ſo often baptized thouſands of the Orientals in one day. It is glorious to preach the goſpel in a foreign country the moment one ſets foot in it. It is no ſmall accompliſhment inſtantly to ſpeak with eloquence, and to move the paſſions, in a language that cannot be learned in many years, and which, after all, we are never able to pronounce, but in a ridiculous manner. Theſe prodigies ought certainly to be huſbanded; and the marvellous, when indiſcreetly laviſhed, ſerves only to augment the number of unbelievers.

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† Let us add to this liſt, M. de Voltaire's deſcription of the battle of Fontenoy, in which he has celebrated an Engliſh column which exiſted no where but in his own imagination.

But it is in travellers, above all, we meet with the greateſt number of printed lies. I paſs over Paul Lucas, who ſaw the devil Aſmodeus in the Upper Egypt. Neither ſhall I take notice of thoſe who deceive us, even whilſt they tell us the truth: they may have ſeen a very extraordinary thing in a country, and take it for a common cuſtom; they may have met with ſome abuſe, and imagine it to have been a law of the land. Theſe authors are much like the German, who happening to have a ſmall difference with his landlady at Blois, whoſe hair was ſomewhat inclinable to the ſandy, put down in his pocket-book, "*Nota bene*, All the women in Blois are red-haired and ſcolds."

What is ſtill worſe is, that moſt of thoſe who write on the ſubject of government, often draw falſe examples from miſtaken travellers, with which they impoſe upon mankind. A Turkiſh emperor may perhaps have confiſcated the treaſure of certain baſhaws, who were born ſlaves in his ſeraglio, and given ſuch ſhare as he thinks proper to the family of the deceaſed; therefore it muſt be a fundamental law in Turky, that the Grand Turk is heir to all his ſubjects: he is a monarch, therefore he muſt be deſpotic, in the moſt horrible ſenſe of the word, and in the manner moſt humiliating and diſgraceful to humanity. The Turkiſh government, which does not allow the emperor to abſent himſelf any length of time from his capital, to change the laws, to touch the public revenue, &c. ſhall be repreſented as an eſtabliſhment in which the prince may lawfully kill and plunder, from morn till night, every one he pleaſes. The Alcoran ſays, it is lawful to be married to four wives at the ſame time; therefore every private tradeſman at Conſtantinople has four wives, as if it were ſo eaſy a matter either to have or maintain ſuch a number. Some perſons of rank have ſeraglios: from hence it is taken for granted, that every Muſſulman is a Sardanapalus; and in this manner do we generally judge of things. A Turk who ſhould have chanced to be at a certain capital, during the celebration of an *Auto da Fé*, would ſurely be miſtaken, ſhould he aſſert, that there is a civilized country where they ſometimes ſolemnly burn a ſcore of men, women, and children, for the amuſement of their gracious majeſties. Moſt relations are written in the ſame taſte. The caſe is ſtill worſe when they happen to be filled with prodigies. In ſhort, we ought to be as much upon our guard againſt what books tell us, as a judge is againſt the pleadings of the lawyers.

There is yet another great ſource of public errors amongſt us, and which is peculiar to our nation: this is the taſte for lampoons and abuſive ſongs. Theſe are ſometimes made on the moſt reſpectable perſonages; and we hear the living and the dead ſlandered every day on ſuch noble foundations as theſe: "It is an undoubted fact, ſay they, there is a ſong about it, which proves it beyond queſtion."

Let us not forget to mention, amongſt the number of printed lies, the rage of making allegories. On finding the fragments of Petronius, to which Nodot has ſince boldly added his own, all the learned took the conſul Petronius for the author of this book. They plainly diſcover Nero, and all his court, in a company of young roguiſh ſcholars, who are the heroes of that work. They were then, and ſtill are, deceived by the name: and that obſcure and creeping debauchee who wrote this ſatire, which is more infamous than ingenious, muſt abſolutely be the conſul Petronius; that abſurd old fellow Turkaret; that financier below Trimalcion himſelf, muſt be the young Nero; and that ſilly inſignificant wife of his, the beautiful Acte; that clowniſh pedant Agamemnon, the philoſopher Seneca. This is like ſeeking Louis XIV. and his whole court, in Gil Blas. But, ſome one will tell me, what advantage do you reap by undeceiving mankind in regard to thoſe trifles? That I ſhall gain nothing, is paſt all doubt; but we ought to accuſtom ourſelves to ſearch for truth even in minute things; for want of which habit, we are egregiouſly deceived in thoſe of conſequence.

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On PRINTED LIES.

Reaſons why we ought to believe that the book entitled, The Political Teſtament of Cardinal Richelieu *is a ſpurious work.*

MY zeal for the diſcovery of truth, my function as hiſtoriographer of France, which requires my applying to hiſtorical reſearches, my ſentiments, which are thoſe of a citizen; the reſpect I bear for the memory of the founder of a body of which I am a member; my perſonal attachment to the heirs of his name and his merit; theſe, I ſay, are my motives for endeavouring to undeceive thoſe perſons who attribute to cardinal Richelieu a work which I have good grounds to think neither is, nor can be his.

I. Even the title of it is ſuſpicious; a perſon who addreſſes his maſter, would never have given his too reſpectful counſels the pompous title of a *Political Teſtament*. Scarce was Richelieu dead, when an hundred different manuſcripts were publiſhed for and againſt his memory. I have two of them under the title of *Teſtamentum Chriſtianum*, and two more under that of *Teſtamentum Politicum*. Theſe are probably what have given riſe to all the Political Teſtaments that have been forged ſince.

II. Had a work, in which one of the greateſt ſtateſmen, that Europe ever bred, is ſuppoſed to give his maſter an account of his adminiſtration, and to offer him his advice with reſpect both to the preſent and the future, had this work been actually wrote by this miniſter, he would certainly have taken all poſſible meaſures that ſuch a monument ſhould not periſh; he would have given the moſt authentic proofs of its being genuine; he would have mentioned it in his real teſtament, in which his laſt requeſts were contained; he would have bequeathed it to the king as a preſent infinitely more valuable than the cardinal-palace; he would have given it in charge to his executors to tranſmit this important work to Louis XIII. The king muſt have mentioned it to ſome one; all the memoirs of thoſe times would have taken notice of an anecdote of this importance: not a tittle of all this has happened. Such a general ſilence in an affair of ſo much weight, cannot fail of raiſing the ſtrongeſt ſuſpicions in the mind of every ſenſible perſon. Why did neither the original manuſcript, nor any copy of it, appear in the ſpace of ſo many years? It was known at the death of Cæſar, that he had written Commentaries: it was known that Cicero had written on eloquence; a manuſcript of Raphael on painting could never have remained a profound ſecret.

III. Moreover, this work is no half-formed deſign, it has actually had the laſt hand put to it. It concludes with a fine peroration full of morality: I *beſeech your majeſty* to *bethink* yourſelf from this moment, of what Philip II. never thought, 'till he was ready to reſign his breath; and to engage you to do ſo by example, as well as precept, I promiſe that not a day of my life ſhall paſs, in which I will not endeavour to reflect on what ought to be my ſentiments at the day of my death, with regard to public affairs. There is nothing wanting to render this work compleat; even the epiſtle didicatory has been found, which they had the effrontery to ſign in Holland, *Armand du Pleſſis*, although the cardinal never ſubſcribed his name in that manner; not ſo much as the table of contents but has been recovered, which the editor is ſo audacious as to aſcribe to the cardinal. Laſtly, in this epiſtle dedicatory they make the cardinal addreſs the king in the following words: *This piece will one day appear under the title of Political Teſtament, that it may be of uſe after my death,* &c. As this piece was to ſee the light after the cardinal's death, it conſequently ought to have been preſented to the king in the moſt ſolemn manner; the original, in like manner, ought to have been ſigned and witneſſed; and laſtly, the very date of the preſentation of this important legacy, ought to have been recorded.

IV. Had this manuſcript fallen into the hands of ſome miniſter of ſtate on the death of Lewis XIII. and ſo had paſſed into thoſe of the perſons who from thence made it public, ſome circumſtances of it ought certainly to have been known; the editor muſt have told by what means he had got poſſeſſion of ſuch a manuſcript, which he would have declared with more boldneſs, as printing it in a free country, near forty years after the death of the cardinal, and when the remembrance of the hatred that had ſubſiſted between the cardinal and certain great families, had entirely ſubſided. The editor, as I have already remarked in another place, was above all under the obligation to aſcertain the authority of this manuſcript, by neglecting of which he muſt acknowledge himſelf unworthy of all manner of credit. Of all theſe conditions, ſo indiſpenſably neceſſary to eſtabliſh the authenticity of a book of ſuch a nature, have ever been fulfilled, and even for a ſpace of four and twenty years complete, from the date of the pretended manuſcript, neither the court nor city, nor any book, nor any journal, make the leaſt mention of any ſuch thing as the cardinal's having left the king a political teſtament.

V. How, indeed, was it poſſible, that Cardinal Richelieu, who, as is well known, found greater difficulty in governing the king his maſter than in guiding the helm of ſtate, ſhould have ever had either leiſure or inclination to compoſe ſuch a work for the uſe of Lewis XIII? The author of the New Chronological

Abridgement of the Hiſtory of France, who is ſo excellent at painting times and perſons, confeſſes in his uſeful performance, that cardinal de Richelieu, *has had much cauſe to be afraid of the king for whom he riſqued his all, as he had to dread the reſentment of thoſe whom he compelled to obey him:* diſappointments, ſuſpicions, and reciprocal diſcontents were daily carried to ſuch a length between king and miniſter, that Cinqmars, Lewis's maſter of horſe, propoſed to his maſter to aſſaſſinate the cardinal de Richlieu as he had done the marſhal d'Ancre, for which he promiſed his perſonal ſervice; this is aſſerted by Louis himſelf in a letter to chancellor Seguier, after the conſpiracy of Cinqmars. The king therefore had given his favourite reaſon to think he might venture to make this ſtrange propoſal. In ſuch a ſituation as this, it is impoſſible one ſhould take the trouble to compoſe for a king, who was already arrived at years of maturity, in the midſt of mutual apprehenſions, a collection of precepts which an unoccupied father might poſſibly have bequeathed to a ſon ſtill in his infancy? I can hardly think ſuch a conduct conſiſtent with human nature. This reaſon will have no effect with one of the learned, but I am ſure it will not fail to perſuade ſuch as have a proper knowledge of mankind.

VI. Let us ſuppoſe, however, a man, ſuch as cardinal Richelieu, to have really had an intention to give the king his maſter proper rules for government after his death, as he had given him whilſt he was living; what man is there, who, on opening this book, would not expect to ſee all the ſecrets of cardinal de Richelieu laid open, and to find his Teſtament breathing the grandeur and boldneſs of his genius? Who would not flatter himſelf with having the pleaſure of diſcovering meaſures at once artful and daring, ſuitable to the then ſtate of Europe, and of France, of the court, and above all, of the monarch? By the firſt chapter it is evident that the author pretends to write in 1640; for he makes cardinal Richelieu in a barbarous jargon, ſpeaking of the war with Spain, ſay, *It is in this war, which has laſted five years only, that you have met with* *any accident*, &c. for this was began in 1635, and the dauphin was born in 1638. How then comes it to paſs, that in a political work, which enters into all the detail of priviledged caſes, of appeals in matters of abuſe, of rights of indulto's, and of the venditions that prevail in the Mediterranean, the education of the preſumptive heir of the crown ſhould have been forgotten? This forger muſt ſurely be a very bungling fellow in his profeſſion. The real cauſe of this omiſſion is, that the author having in ſeveral other parts of his book forgotten he had made as if he had wrote in 1639 and 1640, afterwards takes it into his head to write as if he was then in 1635. He makes the reign of Lewis XIII. no more than five and twenty; whereas he ſhould have made it thirty years, a palpable contradiction and an evident demonſtration of an impoſition which no art can palliate.

VII. Again, Lewis XIV. is engaged in a ruinous war with the houſe of Auſtria; his enemies are on the frontiers of Champagne and Picardy; and yet his firſt miniſter, who has promiſed him his counſels, does not mention a ſingle word to him, neither of the manner in which this dangerous war was to be carried on, nor of the terms of peace to be agreed upon, nor of the generals or plenipotentiaries proper to be employed? Not one word of the conduct to be obſerved with reſpect to counſellor Oxenſtiern, with reſpect to the army of the duke of Weimar, with reſpect to Savoy, Portugal and Catalonia! Nothing is to be met with in regard to the revolutions which the cardinal himſelf fomented in England; nothing of the Huguenot party, which ſtill breathed a ſpirit of faction and vengeance. In all this I think I ſee a phyſician who when called to preſcribe for a ſick-man, entertains his patient with talking about every thing but what relates to his diſorders.

VIII. The perſon, who has vended theſe notions under the name of cardinal de Richelieu, firſt of all avails himſelf of the ſucceſs of that great man in his miniſtry, in order to make him aver that he had promiſed the king his maſter this good fortune. The cardinal had humbled the grandees of the kingdom whoſe power was dangerous, the Huguenots who had the upper hand, and the houſe of Auſtria which was ſtill more to be dreaded: hence he infers, that the cardinal had promiſed the king he would accompliſh thoſe revolutions the moment he ſet foot in the cabinet. Theſe are the words he puts in the mouth of the cardinal. *When your majeſty had formed the reſolution not only to admit me to your councils, but even to a great ſhare in your confidence, I promiſed you I would employ all the authority you ſhould be pleaſed to inveſt me with, in order to deſtroy the Huguenot party, humble the grandees, reduce all your ſubjects to their duty, and raiſe your fame amongſt foreign nations, to that high rank it ought to hold,* &c. Now it is univerſally known, that when Louis XIII. gave his conſent to the admiſſion of cardinal de Richelieu into the council, he was far from being ſenſible of the good he had procured to France as well as to himſelf. It is an acknowledged truth, that the king, who then had a diſlike to this great man, acted merely in compliance with the repeated interceſſions of the queen-mother, who left no ſtone unturned to introduce her favourite, for whom ſhe had lately procured a cardinal's hat, and whom ſhe looked upon as her creature, and by whom ſhe hoped to govern. She at length prevailed, and he was admitted into the council: nevertheleſs it was even found neceſſary to gain over the marquis de la Vieuville, ſuperintendant of the finances, who conſented with a good deal of difficulty to the cardinal's admiſſion into the council in 1624: and he neither held the firſt place there, nor was in any great degree of credit. This whole year paſſed in jealouſies, cabals, and ſecret factions; and the cardinal got the aſcendant only by degrees, and as it were by ſtealth.

It will afford matter of ſatisfaction to ſome readers to learn in this place, that cardinal de Richelieu received his patent of firſt miniſter on the 21ſt of November 1629, and not before. Lewis XIII. ſigned it privately with his own hand. Theſe letters patents are addreſſed by the king to the cardinal himſelf; and what is very remarkable is, that the appointments attached to that new dignity, are left blank in this inſtrument; the king leaving, to the magnificence and diſcretion of his miniſter, the care of taking out of the public treaſury what was neceſſary to ſupport the dignity of his ſtation.

But to return, it is by no means propable the cardinal ſhould have expreſſed himſelf in 1624, in the manner they have made him do. It was certainly much for his honour to have atchieved ſo many great things; but it would have been extremely raſh to have promiſed them: and it would have been the moſt ridiculous and indecent thing in nature, to have told the king his maſter, on his admiſſion into his councils, *I will raiſe your fame.* They make him relate, contrary to his oath of ſecreſy, and againſt all decorum, what he had done: yet he ſays not a word of what ought to be done. Why? becauſe the one was very eaſy, and the other extremely difficult.

IX. By the little we have now ſaid, it already appears, that the pretended work in queſtion is wholly inconſiſtent with the character of the miniſter to whom it is aſcribed, of the king to whom it is addreſſed, and the time in which it is ſuppoſed to have been written; and, I will alſo add, with the ſtile of the cardinal. We need only examine five or ſix of his letters, to be able to judge that it is impoſſible this work ſhould have been done by the ſame hand; and this proof would be ſufficient to convince any one who is poſſeſſed of the leaſt degree of taſte or diſcernment. Moreover, cardinal de Richelieu, though he was ſometimes under the neceſſity of doing violent things, never let any harſh or indecent expreſſions eſcape him. If he was daring in his actions, he was extremely circumſpect in what he wrote: he would certainly never have called, in a political work, the marchioneſs du Fargis, one of the queen's ladies of the bed-chamber, plain Fargis. This would have been the higheſt want of good-breeding and reſpect both to the king and poſterity, to whom he was addreſſing himſelf. This indecent expreſſion is taken from a wretched book, printed in 1649, intituled, The Hiſtory of the Miniſtry of Cardinal de Richelieu. The author of the Teſtament has copied this work of darkneſs, which has been more diſgraced by the contempt of the public than by the arret by which it ſtands condemned.

Can any one be brought to believe, that a firſt miniſter, who ſuppoſes the peace with Spain already concluded, ſhould ſpeak of the Spaniards in ſuch terms as theſe: "This covetous and inſatiable nation, an enemy to the repoſe of Chriſtendom?" He could not have ſpoken of Mahomet II. in worſe terms. It is impoſſible to conceive, that a prieſt, a cardinal, a firſt miniſter, and a man of ſenſe, writing to a wiſe king, and in a teſtament which ought to be exempt from paſſion, ſhould have been ſo little maſter of himſelf (at the time of this ſuppoſed peace) as to let fall expreſſions he would not have uſed in a declaration of war.

X. Is it poſſible that a ſtateſman, propoſing to write a work which required ſo much ſolidity, ſhould ſay, "That the king of Spain, by aſſiſting the Huguenots, had laid the Indies under contribution to hell; that courtiers meaſure the diadem by its form, which, as it is round, has no end; that the elements have no weight, but when they are in their proper places; that neither fire, air, nor water, are capable of ſupporting a terreſtrial body, becauſe ſuch a body gravitates even when out of its place;" with an hundred other abſurdities of the ſame ſort, worthy of a country profeſſor of rhetoric of the ſixteenth century, or of an Iriſh pedagogue diſputing upon a ſtool.

XI. Is there again any great probability, that the cardinal de Richelieu, ſo well known for his gallantries, not to ſay for the over-warmth of his deſires, ſhould recommend the virtue of chaſtity to Lewis XIII a prince chaſte from conſtitution, by conſcience, and by infirmity.

XII. After ſuch ſtrong preſumptions, what man of ſenſe can reſiſt that glaring proof of falſhood to be found in the firſt chapter? I mean the ſuppoſition that the peace was already concluded. You are now come ſays he, to the concluſion of a peace: your majeſty entered into the war wholly,—&c.—and have extricated yourſelf out of it only, &c. . . . An impoſtor, in the hurry of his forgery, forgetting the times of which he ſpeaks, might well fall into ſo groſs an abſurdity; but a firſt miniſter, when he is actually at war, would certainly not have ſaid the war is concluded. The war againſt the houſe of Auſtria was carried on more briſkly than ever, although all the princes of Europe were then in negotiation, and perhaps for that very reaſon. It is true, in 1641, there were ſome foundations laid of the treaties of Munſter, which were not concluded till 1648; and the author of the Teſtament makes cardinal de Richelieu ſpeak ſometimes in 1640, and ſometimes in 1635. The cardinal could neither have ſuppoſed the peace made in the middle of the war, nor fly out into the moſt atrocious invectives againſt the Spaniards at a time when he was deſirous to enter into a treaty with them.

XIII. Can there be any neceſſity to add to this evident proof of a palpable impoſture, a miſtake not quite ſo abſurd indeed, but which, notwithſtanding, ſerves equally well to detect an ignorant liar? He makes a prime miniſter, as the cardinal was, ſay, in the ſame chapter, "that the king refuſed the aſſiſtance of the Ottoman arms againſt the houſe of Auſtria." If he means the aſſiſtance which the Turks were deſirous of giving to the French, the fact itſelf is falſe, and the very ſuppoſing of it ridiculous; if he means a diverſion to be made by the Turks in Hungary, or elſewhere, any man who knows the world, or has the ſmalleſt idea of cardinal Richelieu, well knows that ſuch offers are ſeldom refuſed.

XIV. As it appears, from the firſt chapter, that the impoſtor wrote after the peace of the Pyrenees, of which his imagination was full, it appears, by the ſecond, that he wrote after the reformation which Lewis XIV. made in every part of the adminiſtration. "I remember to have ſeen in my youth, ſays he, gentlemen and other lay perſons poſſeſſed, in truſt, not only of the greateſt part of the priories and abbeys, but alſo of curacies and biſhoprics. At preſent theſe truſts are much rarer than the lawful poſſeſſions were in thoſe days." Now it is certain, that in the latter part of the cardinal's adminiſtration, nothing was more common than to ſee laymen poſſeſſed of benefices. He himſelf was the cauſe of five abbeys being given to the count de Soiſſons, who was killed at La Marſée; M. de Guiſe was poſſeſſed of eleven; the duke de Verneuil had the biſhopric of Mentz; the prince de Conti had the abbey of St. Dennis in 1641; the duke de Nemours had the abbey of St. Remi of Reims; the marquis de Treville that of Moutier-Ender, under the name of his ſon; in a word, the keeper of the ſeals Chateauneuf was in poſſeſſion of ſeveral abbeys till his death, which happened in 1643; ſo that we may judge whether this example was followed. The number of laymen who enjoyed thoſe revenues of the ſtate is almoſt infinite. It is ſufficient to look into the Memoirs of the count de Grammont to have an idea of the manner in which benefices were then obtained. I do not inquire whether the practice of giving away the revenues of the church to ſecular perſons was good or evil; but I ſay, that a dextrous impoſtor would never have made cardinal de Richelieu mention a thing which had no exiſtence at the time he was writing.

XV. In the ſame ſecond chapter, this projector, who is aſſuredly ſome churchman, overflowing with zeal for the pretended rights of the clergy, and altogether as regardleſs of thoſe of the crown, declaims againſt the right of the Regale. He forgot, that in 1637, and in 1638, cardinal de Richelieu had cauſed ſeveral arrets of council to be paſſed, by which every biſhop who ſhould deem himſelf exempt from that right, was obliged to ſend into chancery the titles on which he grounded his pretenſions. This writer knew not that a biſhop, who was miniſter of ſtate, intereſts himſelf more in favour of the rights of the crown, than of that of eccleſiaſtical pretenſions. One ſhould know the character of a firſt miniſter to be able to make him ſpeak conſiſtently. This is an aſs who cloaths himſelf in the lion's hide, but who is eaſily found out by the enormous length of his ears.

XVI. This ignorant forger, in the chapter before us, where he entertains the king with a diſcourſe about univerſities and colleges, inſtead of talking to him about his intereſts, expreſſes himſelf in his clowniſh ſtile (ſection X.) thus: “ The Hiſtory of Benedict XI. againſt whom the Cordeliers, who were piqued on account of the perfection of poverty; to wit, of the revenues of St. Francis, were exaſperated to ſuch a degree, that not only they waged open war with him by their writings, but alſo by the arms of the emperor, under the ſhadow of whoſe wings aroſe an antipope, to the great prejudice of the church, is too ſtrong an example to be under any neceſſity to alledge any more.” Certainly cardinal Richelieu, who was very learned, was not ignorant that this adventure, of which this impoſtor ſpeaks, happened to pope John XXII. and not to pope Benedict XI. There is not a fact in all the eccleſiaſtical hiſtory better known than this; the ridiculouſneſs of it has rendered it famous; the cardinal could not poſſibly have been miſtaken in it: beſides, to inform a king of the great danger ariſing from religious quarrels, there were an hundred more ſtriking examples to have been quoted.

XVII. In the ſame ſection X. chapter II. ſpeaking of the Jeſuits: “ This order, ſays he, which has ſubmitted, by a blind vow of obedience, to a perpetual head, cannot, according to the laws of good policy, be much favoured in a ſtate to which any powerful community might appear dangerous.” I know well this ſtroke is ſomewhat ſoftened a few lines after; but, to be plain, is it poſſible cardinal de Richelieu ſhould have thought the Jeſuits dangerous, a ſet of people, whom he uſed only for his purpoſe, and puniſhed at his will? He who feared neither the queen, nor the princes, nor the houſe of Auſtria, could he be ſuppoſed to ſtand in awe of a few monks? He had even baniſhed ſeveral of the order, as likewiſe ſome fathers of the oratory, and other prieſts, that had been concerned in cabals; but neither he nor the ſtate had any thing to fear from thoſe communities. It had certainly been very extraordinary, that the conqueror of

Rochelle ſhould in his teſtament have been more diſtruſtful of the Jeſuits than of the Huguenots. This reflection is no convincing proof; but, joined to others, it ſerves to ſhew that the author, though he uſurped the name of a firſt miniſter, was yet incapable of aſſuming his ſpirit.

XVIII. Were it neceſſary to confute all the miſtakes with which this performance ſwarms, I ſhould make a volume as large as the Political Teſtament, a work which knavery has compiled; which ignorance, prepoſſeſſion, and reſpect for a great name, have cauſed to be admired; which the patience of the reader can ſcarce endure to read; and which had remained abſolutely unknown, had it appeared under the name of its real author. I have already, in a ſmall work, pointed out ſome of theſe proofs, which ſerve to demonſtrate the impoſture to any one poſſeſſed of the leaſt judgment or taſte. The following, among the reſt, is unanſwerable. The author, who is fond, however unſeaſonably, of making a parade, equally uſeleſs and falſe, of his knowledge in the hiſtory of the affairs of the church, of commerce, and of the marine, takes it into his head in chapter IX. ſection VI. to talk thus with regard to the ſettlements in the Indies: " As for the Weſt-Indies, we know there is very little trade carried on there: Drake, Thomas Cavendiſh, Herberg, l'Hermite, Lemaire, and the late count Maurice, who ſent twelve ſhips thither with deſign to carry on a trade either by force or friendſhip, not being able to find any place proper to make a ſettlement." Remark, I beſeech you, at what time the impoſtor makes cardinal Richelieu ſpeak in this manner. It is in 1640, at the very time when the late count Maurice, who was then actually living, governed the Brazils in the name of the United provinces, and that the Dutch Weſt-India company had been making a very conſiderable progreſs from the year 1662, without the ſmalleſt interruption: obſerve alſo how, in the beginning of the ſame ſection VI. the author confeſſes, " that the Dutch give no ſmall trouble to the Spaniards in the Weſt-Indies, where they are in poſſeſſion of the greateſt part of Brazil." And, indeed, is it poſſible to lay to the door of a ſtateſman ſuch a hodge-podge of errors and contradictions? England, of which he ſpeaks, had already immenſe countries in America. As to Drake and Thomas Cavendiſh, their example is very unſeaſonably quoted: they were not ſent to make ſettlements, but to ruin thoſe of the Spaniards, to diſturb their trade, and to make prizes, in all which they ſucceeded.

XIX. Any perſon inclined to take the trouble of reading the Political Teſtament with attention, would be greatly ſurpriſed to ſee that in fact this book is rather a criticiſm on the adminiſtration of the cardinal, than an expoſition of his conduct, and a connected account of his principles; the whole of it turns on two points, the firſt of which is unworthy of him, and the ſecond an inſult on his memory.

The firſt object is a vague, puerile, common-place, a catechiſm for a prince of ten years old, and moſt egregiouſly ill adapted to a prince in his fortieth year; ſuch are the following chapters: "That the foundation of the happineſs of a ſtate is the reign of godlineſs; that reaſon ought to be the rule of human conduct; that the intereſt of the public ought to be preferred to that of individuals; that foreſight is a neceſſary quality; that every perſon in the ſtate ought to be inveſted with that employ for which he is qualified; that it is very neceſſary to keep flatterers, informers, and plotters, at a diſtance;" with twenty other diſcoveries, equally profound, accompanied with a piece of advice which would have been an inſult to ſo enlightened a prince as Lewis XIII. who might, with great juſtice, have anſwered his miniſter and ſervant, " Talk in this manner to my young ſon, but know better the reſpect due to your maſter.

The ſecond point, which makes the principal part of his ninth chapter, turns on miniſterial projects, which are all of the author's own invention; and every one of them the direct reverſe of thoſe followed in the cardinal's adminiſtration. The author takes it into his head to aboliſh the private money edicts, or, out of his great condeſcenſion, to fix them at a million of gold. Theſe edicts are for iſſuing private ſums for ſecret ſervices, of which no account is given. This is the moſt valuable privilege attached to the place of prime miniſter. No one but an enemy would demand its abolition.

XX. The ninth chapter of the Political Teſtament bears in each page of it the moſt evident proofs of a forgery, the moſt wretchedly executed that can be imagined; here reflections, facts, computations, and every thing elſe, are equally falſe: in this place the author advances, that for every new tax impoſed, the miniſter is obliged in juſtice to augment the pay of the ſoldiery; which, however, has never happened either under Lewis XIII. or Lewis XIV. here, too, whilſt he eaſes the ſhoulders of the people of ſeventeen millions of the taille, he carries the king's revenue all at once to fifty-ſeven millions, which he ſuppoſes commonly to amount to no more than thirty-five; which is a further proof of his ignorance, for the taille alone commonly amounted to thirty-five millions, the farms to eleven, &c. In this likewiſe he propoſes to reimburſe the annuities created by the cardinal, whereof ſeveral were at the twentieth penny, which he rates at the fifth penny; to take from the treaſurers of France two-thirds of their ſalaries; to cauſe the parliaments, chambers of accounts, the grand council, all the courts which he calls ſovereign, to pay their ſhare of the taille, whilſt he claſſes them at the ſame time with the peaſants. Would it not have been extremely becoming in cardinal de Richelieu to propoſe ſo wild and extravagant a meaſure, in order to vilify a body of which he had the honour to be a member by his quality of peer of France, a dignity which he held in equal value with his rank as cardinal!

XXI. With reſpect to the war, it has been already obſerved, that he has not ſo much as mentioned that in which the kingdom was then engaged. But in his vague, general, and chimerical reflections, he recommends the taxing all the ſees of gentlemen, to enrol the nobleſſe, and to keep them in pay; he would have every gentleman compelled to ſerve at the age of five and twenty, he would have none of the roturier, or lower claſs, admitted into the cavalry till five and twenty; that the care of proviſions ſhould be committed only to perſons of quality; that when there was a neceſſity to raiſe fifty ſoldiers, they ſhould raiſe an hundred; and this for no other reaſon that can be diſcovered, but to double their cloathing and enliſting money. What a project this for a miniſter! It is true, the notion of enrolling the nobles, and cauſing the parliament to pay the taille, might have been the offspring of a better head than that of a projector, who, being out of employment, takes it into his head to govern Europe. In the ſame ninth chapter, he likewiſe treats of the affairs relating to the marine: he ſpeaks very learnedly of the great dangers of the navigation between Spain and Italy, and between Italy and Spain, equally chimerical with that of Scylla and Charybdis: he pretends that the ſingle province of Provence has a much greater number of ſea-ports, better as well as ſafer, than thoſe of Spain and Italy put together; an hyperbole capable to perſuade one, that this book was the work of ſome Provençal, that had never ſeen any place but Toulon and Marſeilles, rather than a ſtateſman acquainted with the ſituation of all Europe.

Theſe are part of thoſe chimeras which this clandeſtine politician has publiſhed in the name of that great miniſter, with an hundred times leſs diſcernment than the Abbe de St. Pierre has ſhewn, in aſcribing a part of his political ideas to the duke of Burgundy.

The project relating to the finances, which takes up almoſt the whole of the laſt chapter, is taken from a manuſcript ſtill in being. I have ſeen it: it was written in 1640. This piece makes the king's revenues amount to fifty-nine millions of thoſe times, by the arrangement which it propoſes. The author of the Teſtament ſubtracts two of theſe; in every thing elſe they perfectly agree. Nothing is ſo common as projects of this ſort; ſometimes the miniſters receive ſuch, but very ſeldom read any of them. The forger, whilſt he copied thoſe ideas, makes it very clearly appear, that he never was at the pains to acquaint himſelf properly with the ſtate of the finances of Lewis XIII. He boldly advances, that each of the five years war had loſt no more than ſixty millions and nine hundred thouſand livres. It is, likewiſe, falſe that this expence was paid without extraordinary means: there were a great many taxations, a great many augmentations of ſalaries, which were brought into the finances; the duties were augmented in the provinces; a tax of a crown *per* ton was laid on wine; the taille, which amounted to thirty-ſix millions and two-hundred thouſand livres, was carried to thirty-eight millions and nine-hundred thouſand livres. In a word, moſt of the things related in this book are as wide of the truth as the propoſitions in it are extraordinary.

XXII. It will, no doubt, be aſked, how it was poſſible the public ſhould have paſſed ſuch an affront on the memory of cardinal de Richelieu, as to imagine this book worthy of him? I anſwer, men ſeldom reflect; read with very little attention; judge with precipitation, and receive opinions as they do money, becauſe they are current.

XXIII. If it be objected to me, that father le Long and others have thought this book the work of the cardinal, I will acknowledge that father le Long has very accurately compiled about thirty thouſand titles of books, and will add, that for that very reaſon he had no time to examine the books themſelves: but above all, I will anſwer, that had we as many authorities as father le Long has compoſed titles, they would not be able to counterbalance one ſolid reaſon. If, however, the weakneſs of men muſt needs reſt their belief on authorities, I will oppoſe to father le Long and others, Aubery, who has written the life of cardinal Mazarine, Ancillon, Richard, the writer who took the title of Vigneul de Morville, and laſtly le Monnoie, one of the moſt enlightened critics of the laſt age; all of theſe pronounced the Political Teſtament ſpurious.

XXIV. But, ſay they, in 1664 the Abbe des Roches, formerly a domeſtic of the cardinal de Richelieu, gave his library to the Sorbonne, after the example of his maſter; and in this library there was found a manuſcript of the Teſtament, which tallied exactly with the printed copy, together with the ſame epiſtle dedicatory, and the ſame table of contents. It is this very manuſcript, ſo tranſmitted to the Sorbonne, which finiſhes the proof of this forgery. It is tranſmitted two and twenty years after the death of the cardinal, without any document or information from the Abbe des Roches. This work was thrown by for a time both by the ſervant of the cardinal, and even the Sorbonne itſelf, and it is within theſe two years it has been claſſed among the reſt. Had this manuſcript been copied from the original, it had been more reſpected, ſome marks of its authority would have been diſcovered, the ſignature of the cardinal de Richelieu would have been found at the end of the letter to the king. But no ſuch ſignature is to be ſeen. They who compoſed it had not the effrontery; they did not dare to ſign that name. Had the cardinal left ever ſo few memoirs, and had they had the ſmalleſt, and even the moſt diſtant relation to the Teſtament, ſome mention would have been made of them, and then ſome degree of credit might have been given to the boldneſs of him who imputed the whole of this work to the miniſter. This is by no means the caſe: there is not a ſingle word, either at the beginning or end of this manuſcript, from whence the ſmalleſt inference can be drawn. Therefore the Abbe des Roches muſt have looked upon this manuſcript with the ſame indifference with which it has been regarded in the Sorbonne.

Let us imagine for a moment the Teſtament to be really the work of the cardinal; the ſingle word teſtament ſuppoſes an indiſpenſable duty in this domeſtic to aſcertain the genuineneſs of the copy, and to declare its being juridically compared and collated with the original. If he has failed in this, he is certainly culpable; he gives the world a right to accuſe him of forgery. But the Abbe des Roches had this manuſcript in his poſſeſſion juſt as any other perſon of curioſity might have had. This manuſcript muſt certainly have been written before it was printed; and even to favour the deſign of the impoſture, ſeveral manuſcript copies of it muſt have been made, which ought to have been handed about in a very private manner, as a monument of ſingular curioſity. Farther, the ſilence of this domeſtic proves the maſter not to have been the author of this teſtament, as all the other arguments are a ſolid proof he never could have been its author.

XXV. But it is ſaid, that it has been affirmed about ſeventy years ago, that the dutcheſs d'Aiguillon ſhould have ſaid fourſcore years ſince, ſhe had once had a manuſcript copy of this teſtament. An original note of Mr. Huet has been found; which note ſays, that ſomebody had ſeen this manuſcript in the poſſeſſion of the dutcheſs d'Aiguillon, niece to the cardinal. Are not theſe very fine proofs? Moſt aſſuredly. I can eaſily believe, that all thoſe who intereſt themſelves in behalf of the cardinal's memory would have been glad to have had any manuſcript that bore his name; and from this circumſtance, I conclude that this manuſcript was evidently ſuppoſititious, ſince among all the relations, all the domeſtics, all the friends of that miniſter, no one has ever given himſelf the ſmalleſt trouble in order to aſcertain the authenticity of this performance.

XXVI. Let human curioſity weary itſelf in idle inquiries after the name of the forger; I, for my part, do not chuſe to trifle away my time in ſuch a manner. What imports it to know the name of the cheat now the impoſture is diſcovered? what imports it to know that Courtils, or ſome other, forged the teſtaments of Mazarine, Colbert, and de Louvois? what imports it whether it were Stratman or Chevremont, that inſolently uſurped the name of Charles V. duke of Lorraine? does it entitle a man to fame, to have been the author of an execrable book? what advantage ſhould one reap by knowing the authors of all the low calumnies and impertinent criticiſms with which the public is overwhelmed? we ought to leave thoſe authors, who cover themſelves under ſome great name, in their native obſcurity, in the ſame manner as we do thoſe who every day attack what is moſt praiſeworthy, and commend what is moſt execrable, thus making the profeſſion of letters as baſe and contemptible as themſelves.

END of the SIXTEENTH VOLUME.

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